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bürkert
FLUID CONTROL SYSTEMS

Type 8692, 8693
Positioner

Electropneumatic positioner

Operating Instructions

Bedienungsanleitung
Manuel d‘ utilisation

MAN 1000108626 EN Version: - Status: RL (released | freigegeben) printed: 04.07.2008

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Operating Instructions 0804/00_EU-ML_00806169

Positioner Type 8692, 8693

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General Information and Safety Instructions

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1 THE OPERATING INSTRUCTIONS

The operating instructions describe the entire life cycle of the device. Keep these instructions in a location which is easily accessible to every user and make these instructions available to every new owner of the device.

WARNING!

The operating instructions contain important safety information!

Failure to observe these instructions may result in hazardous situations.

- The operating instructions must be read and understood.

1.1 Symbols

DANGER!

Warns of an immediate danger!

- Failure to observe the warning may result in a fatal or serious injury.

WARNING!

Warns of a potentially dangerous situation!

- Failure to observe the warning may result in serious injuries or death.

CAUTION!

Warns of a possible danger!

- Failure to observe this warning may result in a moderately severe or minor injury.

CAUTION! (without hazard symbol)

Warns of damage to property!

- Failure to observe the warning may result in damage to the device or the equipment.

designates additional significant information, tips and recommendations which are important for your safety and the proper function of the device.

refers to information in these operating instructions or in other documentation.

→ designates a procedure which you must carry out.

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2 INTENDED USE

WARNING!

Incorrect use of the positioner Type 8692 and Type 8693 can be dangerous to people, nearby equipment and the environment.

- The device must not be used outside.
- The device must not be exposed to direct sunlight.
- Technical direct voltage must not be used as the power supply.
- During use observe the permitted data, the operating conditions and conditions of use specified in the contract documents and operating instructions, as described in chapter *"System Description" - "Technical Data"* in this manual and in the valve manual for the respective pneumatically actuated valve.
- The device may be used only in conjunction with third-party devices and components recommended and authorized by Bürkert.
- In view of the wide range of possible application cases, check whether the positioner is suitable for the specific application case and check this out if required.
- Correct transportation, correct storage and installation and careful use and maintenance are essential for reliable and problem-free operation.
- Use the positioner Type 8692 and Type 8693 only as intended.

2.1 Restrictions

If exporting the system/device, observe any existing restrictions.

2.2 Foreseeable Misuse

- The positioner Type 8692 and Type 8693 must not be used in areas where there is a risk of explosion.
- Do not introduce any aggressive or flammable media into the system's media connections.
- Do not introduce any liquids into the media connections.
- Do not put any loads on the housing (e.g. by placing objects on it or standing on it).
- Do not make any external modifications to the device housings. Do not paint the housing parts or screws.

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3 GENERAL SAFETY INSTRUCTIONS

These safety instructions do not make allowance for any

- contingencies and events which may arise during the installation, operation and maintenance of the devices.
- local safety regulations; the operator is responsible for observing these regulations, also with reference to the installation personnel.

DANGER!

Danger – high pressure!

- There is a serious risk of injury when reaching into the equipment.
- Before loosening the lines and valves, turn off the pressure and vent the lines.

Risk of electric shock!

There is a serious risk of injury when reaching into the equipment.

- Before starting work, always switch off the power supply and safeguard to prevent re-activation!
- Observe applicable accident prevention and safety regulations for electrical equipment!

WARNING!

Unintentional activation or non-permitted impairment may cause general hazardous situations through to physical injury.

- Take appropriate measures to prevent the equipment from being accidentally actuated!

Hazardous situations can arise during installation and maintenance work.

- This work may be carried out by authorized technicians only and with the appropriate tools!
- After an interruption in the power supply or pneumatic supply, ensure that the process is restarted in a defined or controlled manner!

CAUTION!

The general rules of technology apply to applications planning and operation of the device!

Failure to observe these rules may result in injuries and/or damage to the device, and possibly its environment as well.

- Observe the general rules of technology!

CAUTION!

Electrostatic sensitive components / modules!

- The device contains electronic components which react sensitively to electrostatic discharge (ESD). Contact with electrostatically charged persons or objects is hazardous to these components. In the worst case scenario, they will be destroyed immediately or will fail after start-up.
- Observe the requirements in accordance with EN 100 015 – 1 to minimize or avoid the possibility of damage caused by sudden electrostatic discharge!
- Also ensure that you do not touch electronic components when the power supply voltage is present!

The positioners Type 8692 and Type 8693 were developed with due consideration given to the accepted safety rules and are state-of-the-art. However, dangers can still arise.

Operate the device only when it is in perfect condition and in accordance with the operating instructions.

Failure to observe these instructions and unauthorized tampering with the device release us from any liability and also invalidate the warranty covering the devices and accessories!

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4 GENERAL INFORMATION

4.1 Scope of supply

Check immediately upon receipt of delivery that the contents are not damaged and that they correspond to the type and quantity as indicated on the delivery note or packing list.

Generally this consists of:
Pneumatically actuated valve of Type 2300 or 2103 with attached positioner, the operating instructions for the positioner and for the valve with pneumatic drive.

For the multipole version of the positioner we will provide you with cable connectors as suitable accessories.

If there are any discrepancies, please contact us immediately.

Germany

Contact address:

Bürkert Fluid Control System
Sales Center
Chr.-Bürkert-Str. 13-17
D-74653 Ingelfingen
Phone: 07940 - 10 111
Fax: 07940 - 10 448
e-mail: info@de.buerkert.com

International

Contact addresses can be found on the final pages of these operating instructions.

And also on the internet at:
www.burkert.com ➔ Bürkert ➔ Company ➔ Locations

4.2 Warranty terms

This document does not offer any form of warranty. Please refer to our general terms of sales and business. The warranty is only valid if the positioner Type 8692 and Type 8693 is used as intended in accordance with the specified application conditions.

The warranty extends only to defects in the positioners Type 8692 and Type 8693 and their components.
We accept no liability for any kind of consequential damage which could occur due to failure or malfunction of the device.

4.3 Master code

Operation of the device can be locked via a freely selectable user code. In addition, there is a non-changeable master code with which you can perform all operator control actions on the device. This 4-digit master code can be found in the Appendix of these operating instructions in the chapter entitled Master code.

If required, cut out the code and keep it separate from these operating instructions.

4.5 Information on the Internet

The operating instructions and data sheets for Type 8692 and Type 8693 can be found on the Internet at:

www.burkert.com ➔ Documentation ➔ manuals / data sheets ➔ Type 8692 or Type 8693

There is also complete documentation on CD. The complete operating instructions can be ordered by quoting the following identification number: 806 169

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Description of System

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1 FUNCTION OF THE POSITIONER AND COMBINATION WITH VALVE TYPES

Positioners Type 8692 and Type 8693 are electropneumatic positioner for pneumatically actuated control valves with single-acting or double-acting actuators.

Together with the pneumatic actuator the positioner forms an optical and functional unit.

The control valve systems can be used for a wide range of control tasks in fluid technology and, depending on the application conditions, different process valves belonging to series 2300 or 2103 from the Bürkert range can be combined with the positioner. Angle-seat valves, diaphragm valves or ball valves fitted with a control cone are suitable.

Fig. 1 shows an overview of the possible combinations of positioner and different pneumatically actuated valves. Different actuator sizes and valve nominal widths, not illustrated here, are available for each type. More precise specifications can be found on the respective data sheets. The product range is being continuously expanded.

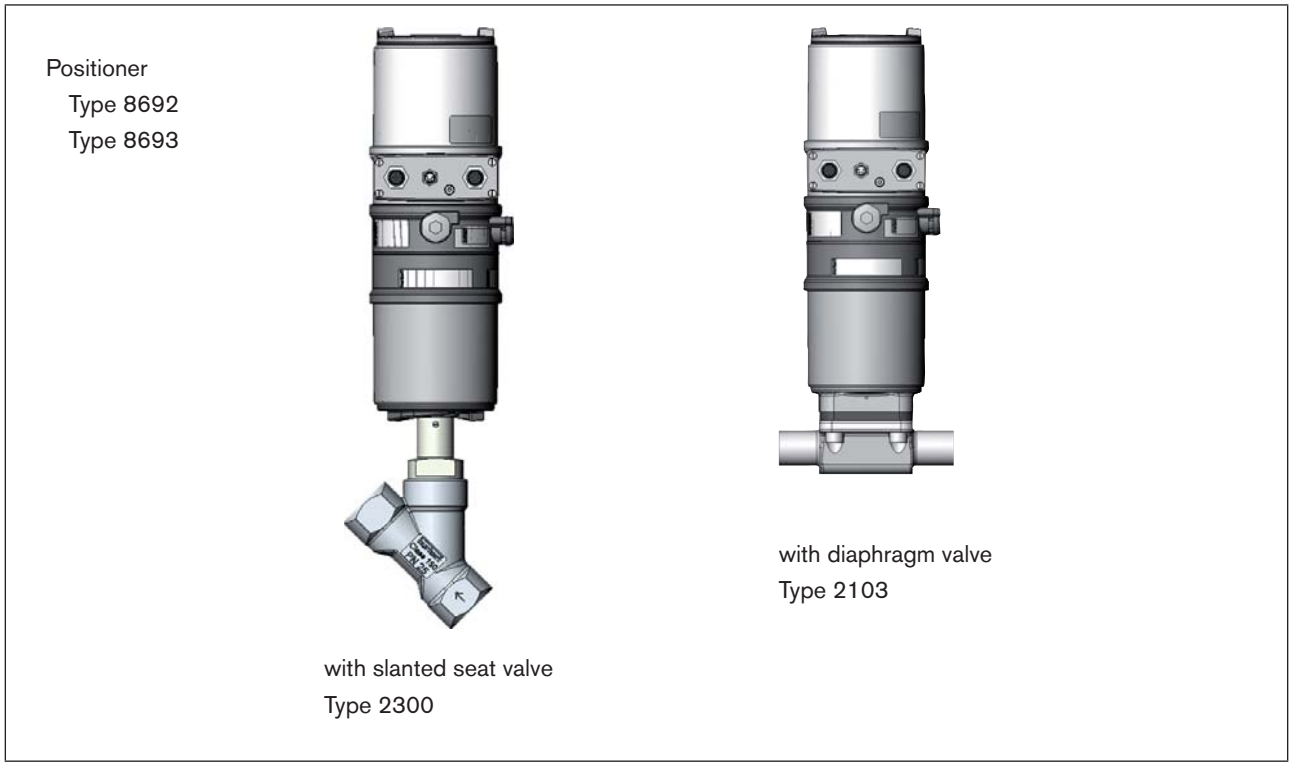

Fig. 1: Overview of possible combinations

1.1 Models of the positioner

The positioner is available in 2 versions:

Type 8692- Positioner with positioning control

The position of the actuator (stroke) is regulated according to the position set-point value. The position set-point value is specified by an external uniform signal (or via field bus).

Type 8693- Positioner with process control

The positioner is linked to a control circuit. The position set-point value of the valve is calculated from the process set-point value and the actual process value via the control parameters (PID controller). The process set-point value can be set by an external signal.

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Pneumatically actuated piston actuators and rotary actuators can be used as a actuator. Both single-acting and double-acting actuators are offered in combination with the positioner.

For single-acting actuators, only one chamber is aerated and deaerated during actuation. The generated pressure works against a spring. The piston moves until there is an equilibrium of forces between compressive force and spring force.

For double-acting actuators the chambers on both sides of the piston are pressurised. In this case, one chamber is aerated when the other one is deaerated and vice versa. In this design, no spring is installed in the actuator.

1.2 Features of the valve types

	Slanted seat control valves / screw-down stop globe control valves	Diaphragm valves	Ball valves	Flap valves
Types	▪ 2702 ▪ 2712 ▪ 2300 ▪ 2301	▪ 2730 ▪ 2103 ▪ 2731	▪ 2652 ▪ 2655 ▪ 2658	▪ 2672 ▪ 2675
Features	▪ incoming flow under seat ▪ closes smoothly ▪ straight flow path of the medium ▪ self-adjusting stuffing box for high leak-tightness	▪ medium is hermetically separated from the actuator and environment ▪ cavity-free and self-draining body design ▪ any flow direction with low-turbulence flow ▪ steam-sterilizable ▪ CIP-compliant ▪ closes smoothly ▪ actuator and diaphragm can be removed when the body is installed	▪ scrapable ▪ minimum dead space ▪ unaffected by contamination ▪ little pressure loss compared to other valve types ▪ seat and seal can be exchanged in the three-piece ball valve when installed Information Can be used as process controller only	▪ unaffected by contamination ▪ little pressure loss compared to other valve types ▪ inexpensive ▪ low construction volume
Typical media	▪ water, steam and gases ▪ alcohols, oils, propellants, hydraulic fluids ▪ salt solutions, lyes (organic) ▪ solvents	▪ neutral gases and liquids ▪ contaminated, abrasive and aggressive media ▪ media of higher viscosity	▪ neutral gases and liquids ▪ clean water ▪ slightly aggressive media	▪ neutral gases and liquids ▪ slightly aggressive media

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2 STRUCTURE OF THE POSITIONER

The positioners Type 8692 and Type 8693 consist of the micro-processor controlled electronics, the position measuring system and the control system.

The appliance is designed using three-wire technology. Operation of the positioner is controlled by four keys and a 128x64 dot matrix graphic display.

The pneumatic control system for single or double-acting actuators consists of two or four solenoid valves.

2.1 Representation

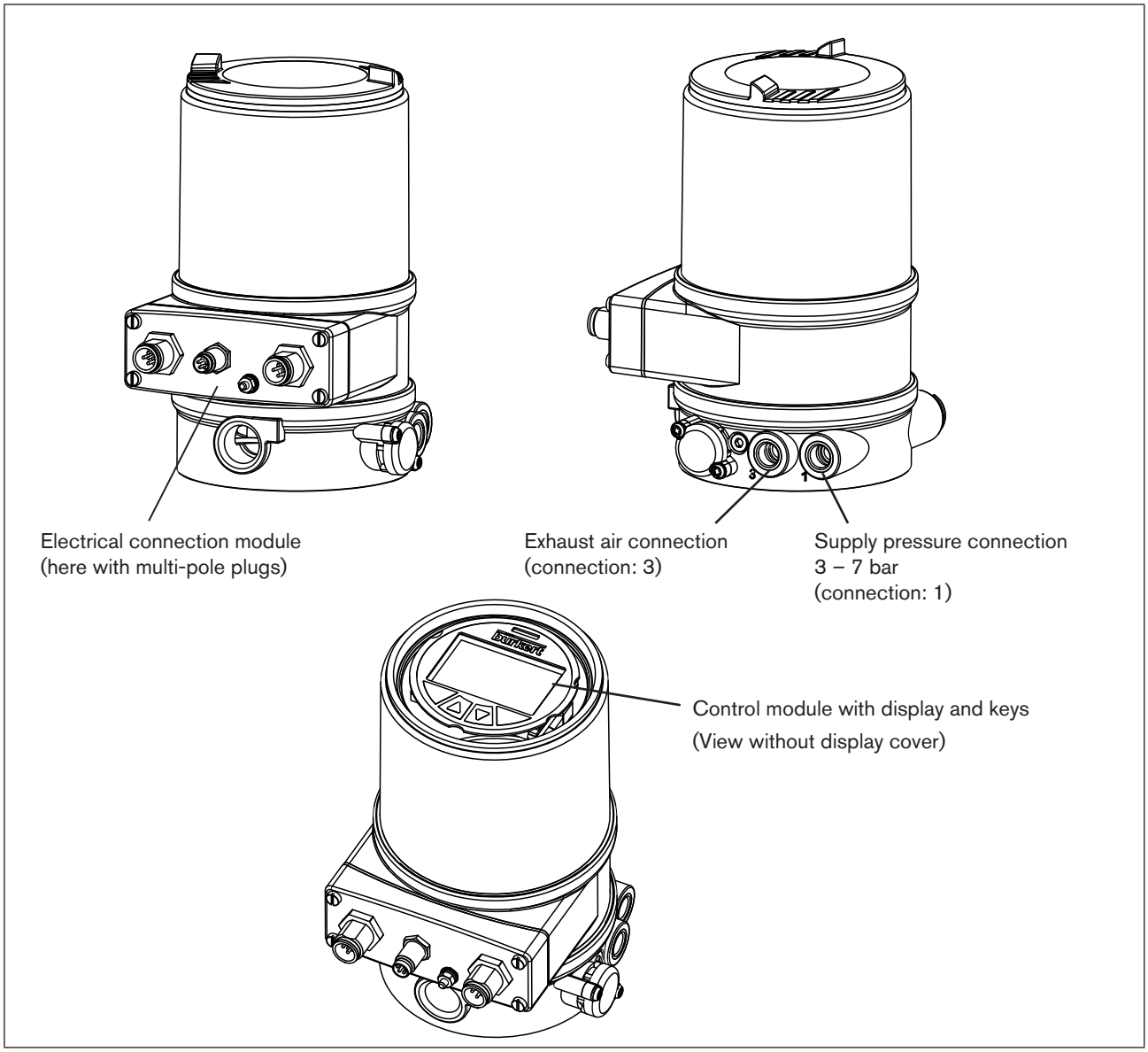

Fig. 2: Structure

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2.2 Features

- **Models**
  for single-acting or double-acting valve actuators.
- **Position measuring system**
  Non-contact and therefore non-wearing position measuring system.
- **Microprocessor-controlled electronics**
  for signal processing, control and valve control.
- **Control module**
  Operation of the device is controlled by four keys. The 128x64 dot matrix graphics display enables you to display the set-point or actual value and to configure and parameterize via menu functions.
- **Control system**
  The control system consists of 2 solenoid valves for single-acting actuators or four solenoid valves for double-acting actuators. In single-acting actuators, one valve serves for the aeration and another for the deaeration of the pneumatic piston actuator. Double-acting actuators feature 2 valves for aeration and deaeration. The solenoid valves operate according to the rocker principle and are controlled with a PWM voltage via the controller. Doing so achieves a higher flexibility with regard to actuator volume and final control speed. On larger pneumatic actuators the solenoid valves feature diaphragm reinforcers to increase the maximum flow and therefore improve the dynamics.
- **Position feedback (optional)**
  One inductive proximity switch (initiator).
  When the valve reaches an upper or a lower position, this can be relayed e.g. to a PLC via binary outputs. By means of set-screws, the operator can change the initiators or limit positions.
- **Pneumatic interfaces**
  1/4" connections with different thread forms (G, NPT)
  Hose plug-in connection

- **Electrical interfaces**
  Multi-pole plug or cable gland

- **Body**
  The body of the positioner is protected from excessively high internal pressure, e.g. caused by leaks, by a pressure limiting valve.

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2.3 Function diagram of the positioner with single-acting actuator

The black lines describe the function of the position controller (Type 8692). The process controller (Type 8693) includes the position controller and the functions which are illustrated in grey.

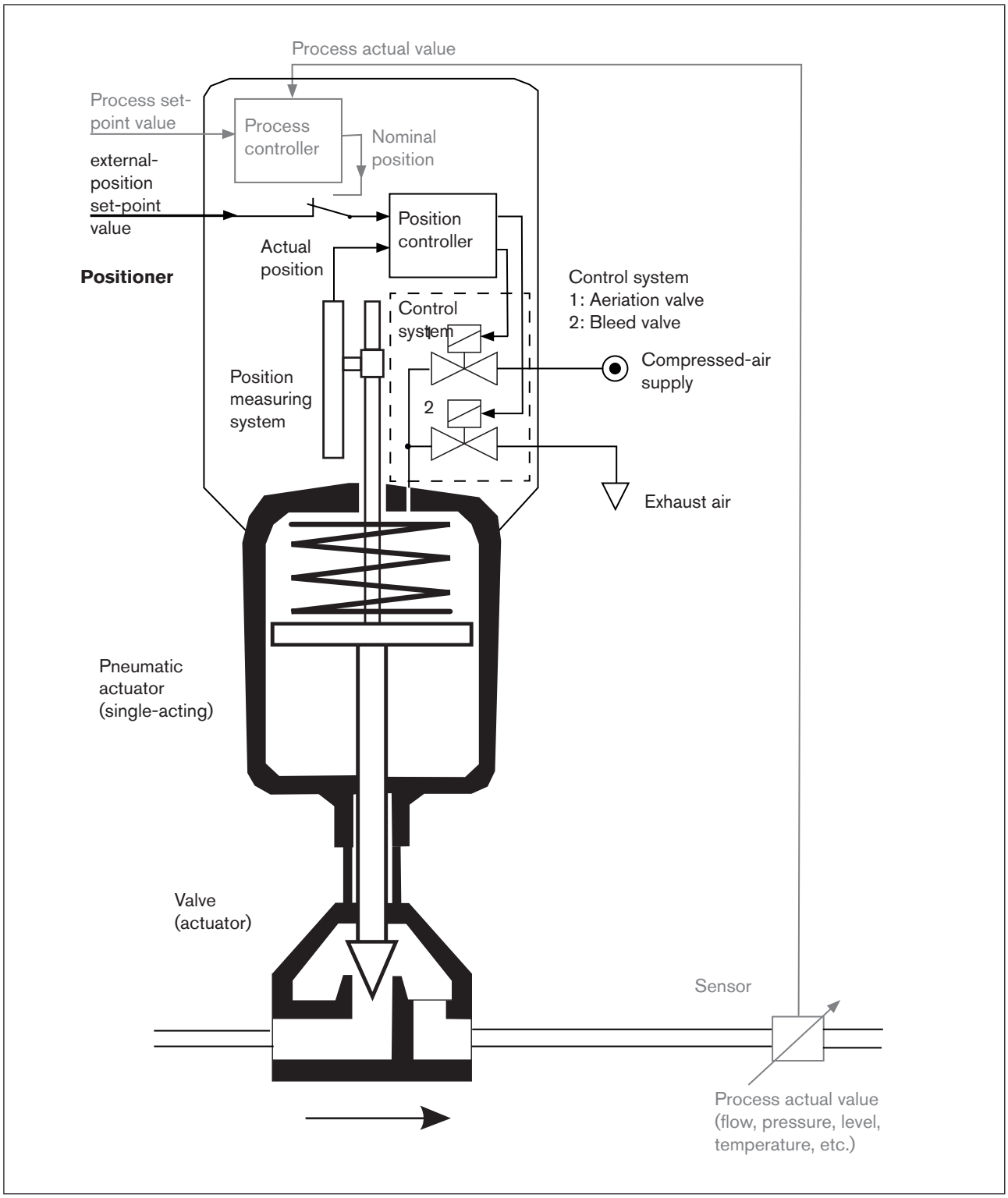

Fig. 3: Function diagram

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3 TYPE 8692 POSITIONER WITH POSITION CONTROLLER

The position measuring system records the current position (*POS*) of the pneumatic actuator. The position controller compares this actual position value with the set-point value (*CMD*), which is definable as norm signal. In case of a control deviation (Xd1), a pulse-width modulated voltage signal is sent to the control system as a manipulated variable. If there is a positive control difference in single-acting actuators, the air inlet valve is controlled via output B1. If the control difference is negative, the bleed valve is controlled via output E1. In this way the position of the actuator is changed until control difference is 0. Z1 represents a disturbance variable.

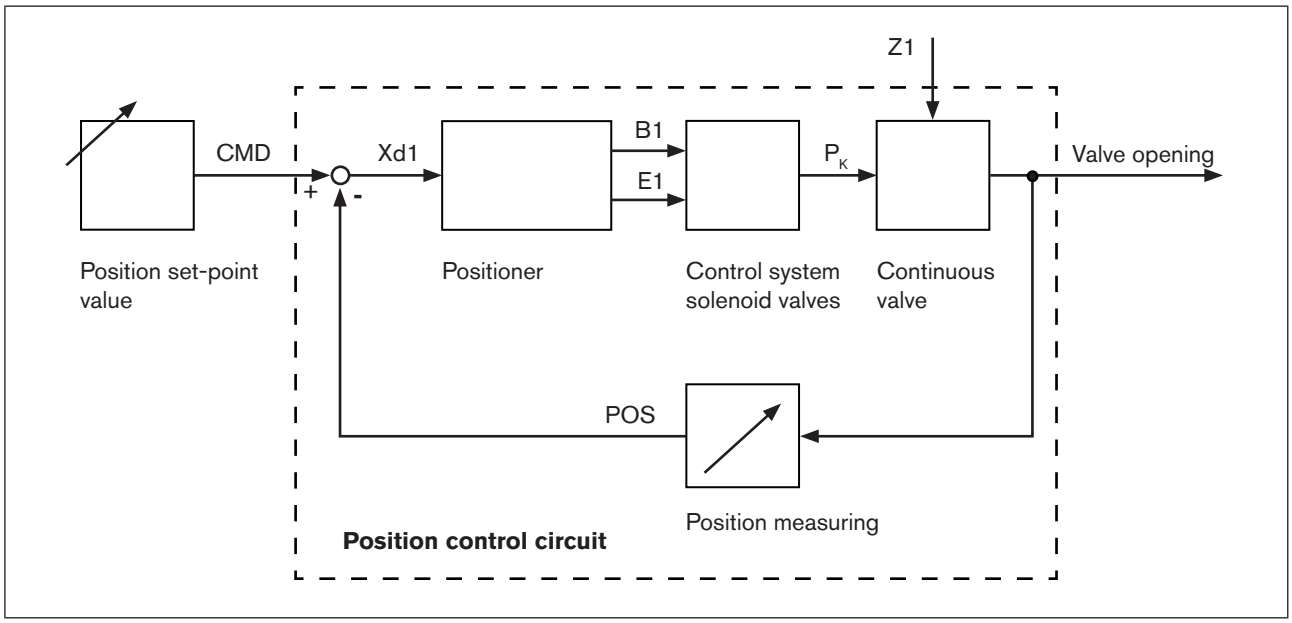

Fig. 4: Signal flow plan of position controller

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3.1 Schematic representation of the positioner Type 8692

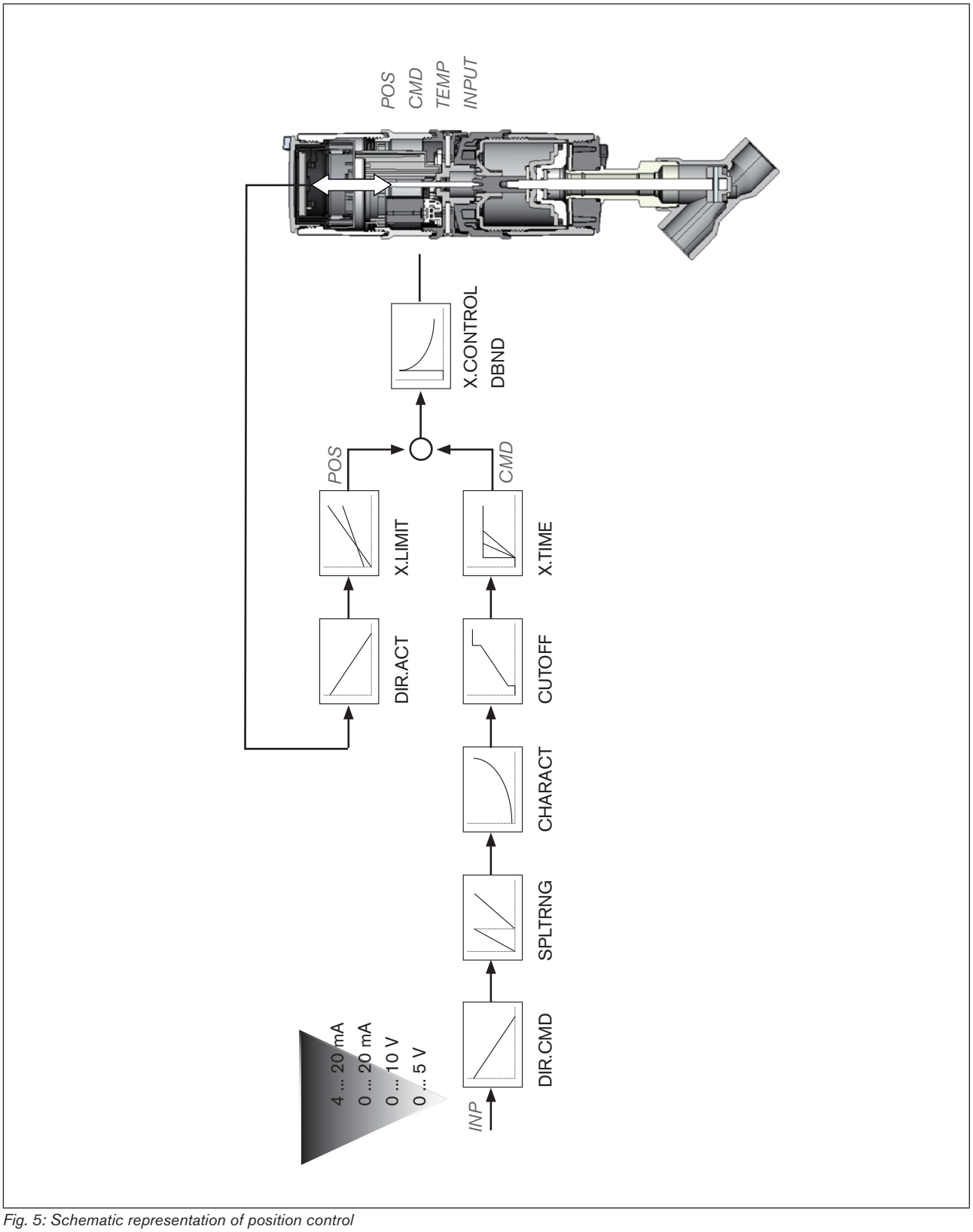

Fig. 5: Schematic representation of position control

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3.2 Properties of the position controller software

Additional function	Action
Position controller with additional function	
Sealing function *CUTOFF*	Valve closes tight outside the control range. Specification of the value (in %), from which the actuator is completely de-aerated (when 0%) or aerated (when 100%).
Stroke limit *X.LIMIT*	Mechanical valve piston movement only within a defined stroke range
Signal range splitting *SPLTRNG*	Splitting of the uniform signal range to two or more positioners
Correction line to adjust the operating characteristic *CHARACT*	The process characteristic can be linearized
Insensitivity range *X.CONTROL*	The position controller is initially actuated from a control difference to be defined
Effective sense of direction of the controller nominal value *DIR.CMD*	Reversal of the effective sense of direction of the nominal value
Safety position *SAFEPOS*	Definition of the safety position
Limit of the control speed *X.TIME*	Input of the opening and closing time for the entire stroke
Effective directional sense of the actuator *DIR.ACT*	Adjustment of the effective sense of direction between aeration state of the actuator and the actual position
Signal level error detection *SIG.ERROR*	Check the input signals for sensor break. Warning output on the display and start up of the safety position (if selected)
Binary input *BINARY. IN*	Switch over AUTOMATIC-MANUAL or Start up of the safety position
Analogue feedback (option) *OUTPUT*	Status signal set-point or actual value
2 binary outputs (option) *OUTPUT*	Output of two selectable binary values.
User calibration *CAL.USER*	Change to the factory calibration of the signal input

Hierarchical control concept for easy control on the following levels	
Process control	On this level switch between AUTOMATIC and MANUAL mode.
Configuration and parameterisation	On this level specify certain basic functions during start-up and, if required, configure additional functions

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4 TYPE 8693 POSITIONER WITH PROCESS CONTROLLER

If the positioner is operated with process controller Type 8693, the aforementioned position control becomes the subordinate auxiliary control circuit; this results in a cascade control. The process controller in the main control circuit of the positioner has a PID function. The process set-point value (*SP*) is specified as set-point value and compared with the actual value (*PV*) of the process variable to be controlled. The position measuring system records the current position (*POS*) of the pneumatic actuator. The position controller compares this actual position value with the set-point value (*CMD*), which is determined by the process controller. In case of a control deviation (Xd1), a pulse-width modulated voltage signal is sent to the control system as a manipulated variable. If there is a positive control difference in single-acting actuators, the air inlet valve is controlled via output B1. If the control difference is negative, the bleed valve is controlled via output E1. In this way the position of the actuator is changed until control difference is 0. Z2 represents a disturbance variable.

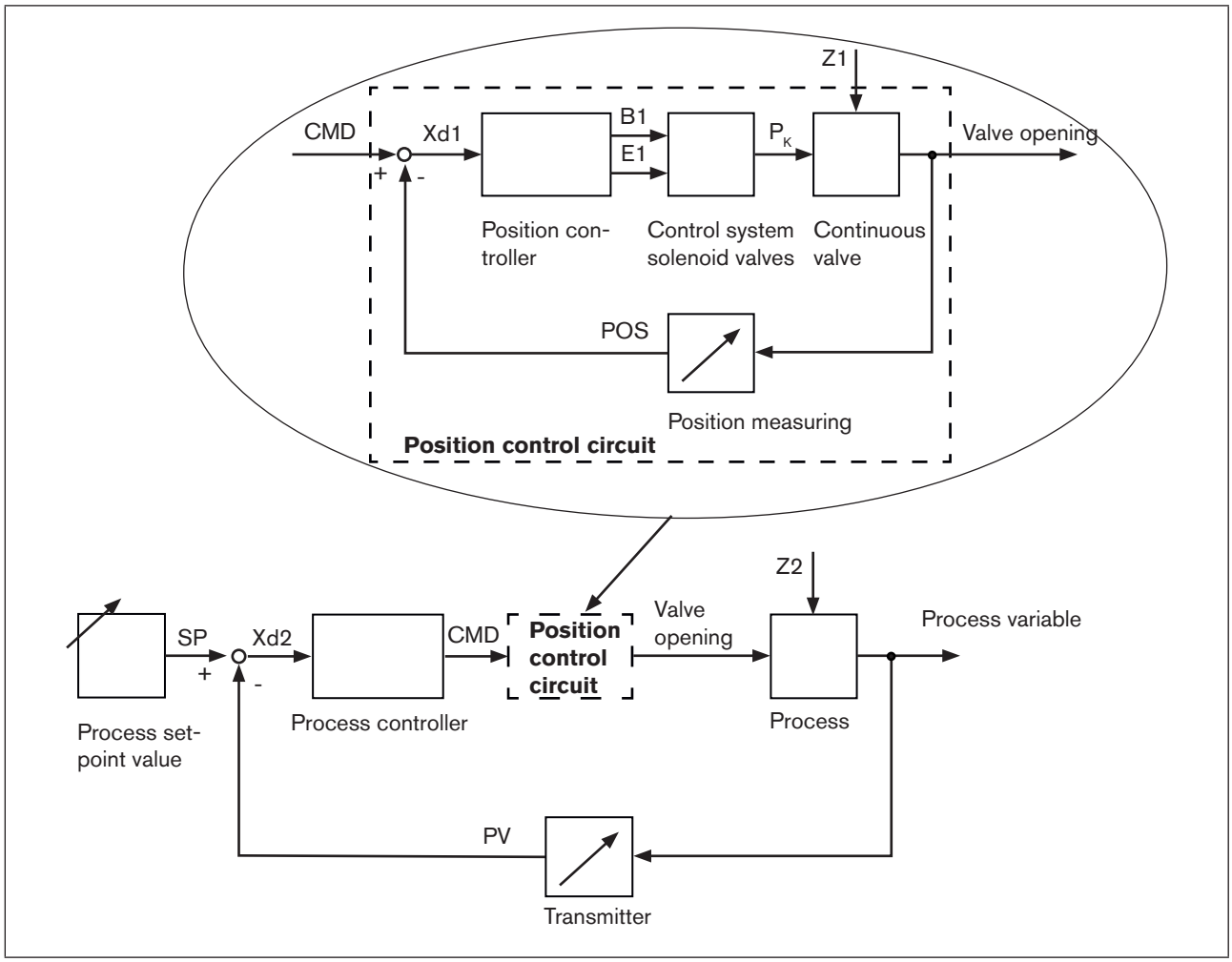

Fig. 6: Signal flow plan of process controller

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4.1 Schematic representation of the process control

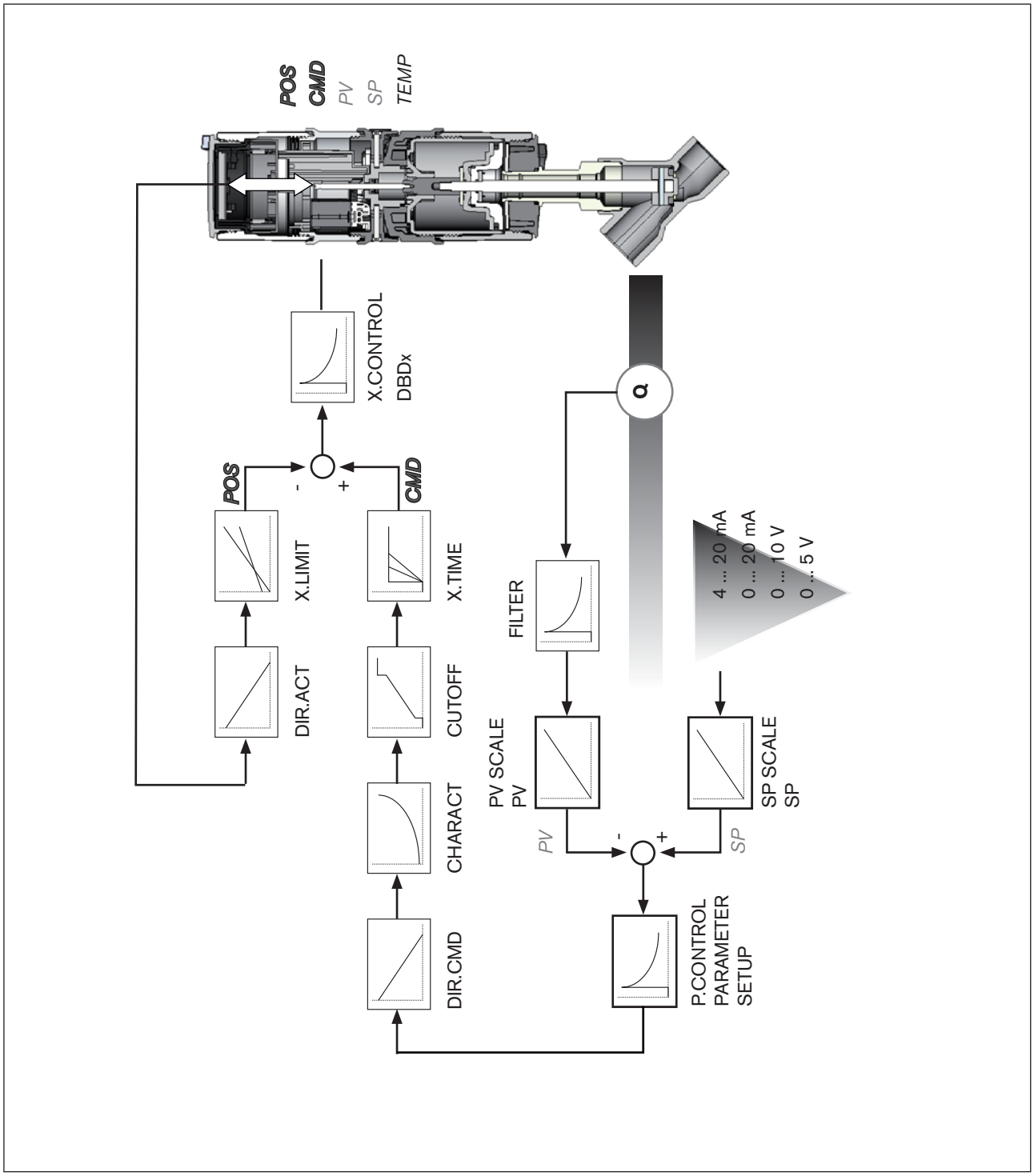

Fig. 7: Schematic representation of process control

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4.2 Properties of the process controller software

Additional function	Action
Position controller with additional function	
Sealing function *CUTOFF*	Valve closes tight outside the control range. Specification of the value (in %), from which the actuator is completely deaerated (when 0%) or aerated (when 100%).
Stroke limit *X.LIMIT*	Mechanical valve piston movement only within a defined stroke range
Correction line to adjust the operating characteristic *CHARACT*	The process characteristic can be linearized
Insensitivity range *X.CONTROL*	The position controller is initially actuated from a control difference to be defined
Effective sense of direction of the controller nominal value *DIR.CMD*	Reversal of the effective sense of direction of the nominal value
Safety position *SAFEPOS*	Definition of the safety position
Limit of the control speed *X.TIME*	Input of the opening and closing time for the entire stroke
Effective directional sense of the actuator *DIR.ACT*	Adjustment of the effective sense of direction between aeration state of the actuator and the actual position
Signal level error detection *SIG.ERROR*	Check the input signals for sensor break. Warning output on the display and start up of the safety position (if selected)
Binary input *BINARY. IN*	Switch over AUTOMATIC-MANUAL or Start up of the safety position
Analogue feedback (option) *OUTPUT*	Status signal set-point or actual value
2 binary outputs (option) *OUTPUT*	Output of two selectable binary values.
User calibration *CAL.USER*	Change to the factory calibration of the signal input
Process controller with the following properties	
Controller structure *P.CONTROL*	PID
Adjustable parameters *P.CONTROL - PARAMETER*	Proportional coefficient, reset time, hold-back time and operating point
Scalable inputs *P.CONTROL - SETUP*	Position of the decimal points, lower and upper scale values of the actual process value and the process set-point value
Selection of the nominal value specification *P.CONTROL - SETUP - SP INPUT*	Set-point value specification either via uniform signal input or via keys

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Hierarchical control concept for easy control on the following levels	
Process control	On this level switch between AUTOMATIC and MANUAL mode.
Configuration and parameterisation	On this level specify certain basic functions during start-up and, if required, configure additional functions

5 INTERFACES OF THE POSITIONER FOR THE MULTIPOLE MODEL

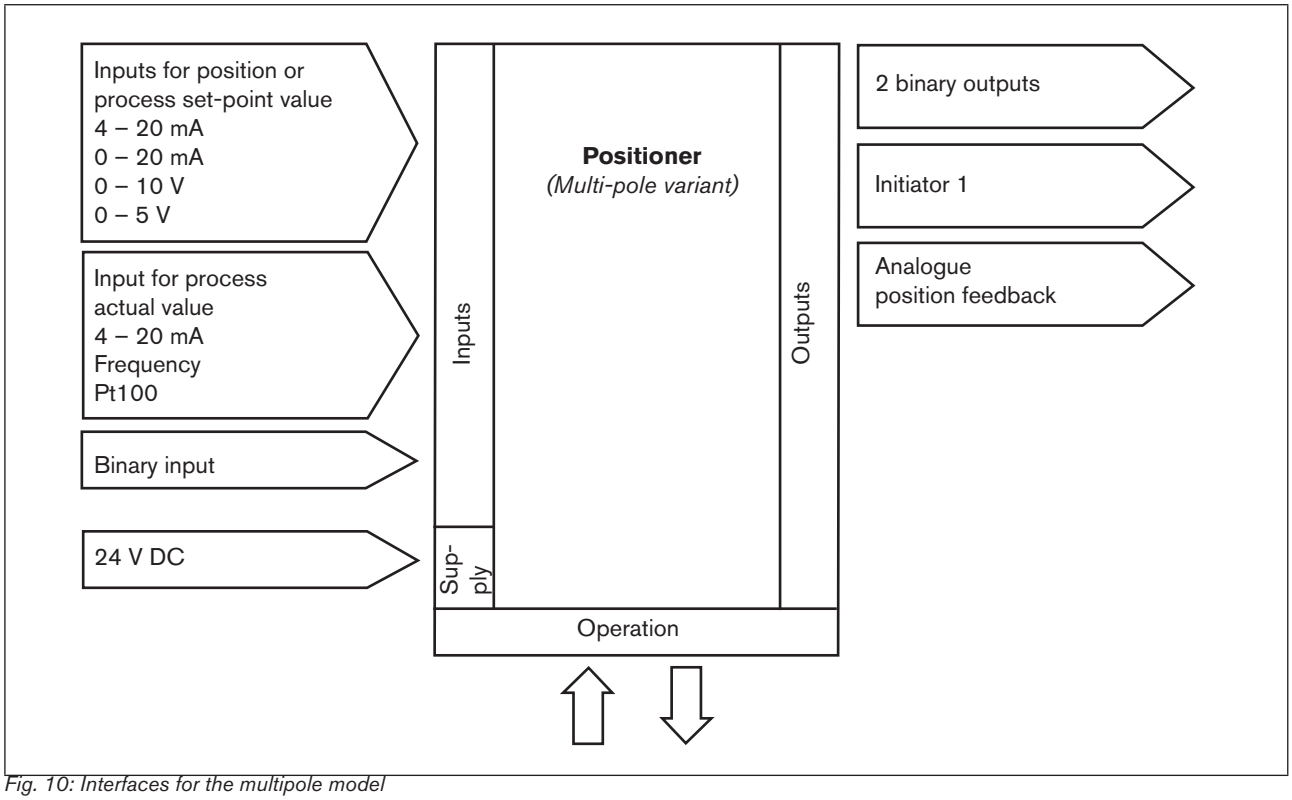

Fig. 10: Interfaces for the multipole model

The positioners Type 8692 and Type 8693 are 3-wire devices, i.e. the power (24 V DC) is supplied separately from the set-point value signal.

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6 INTERFACES OF THE POSITIONER FOR THE MODELS WITH CABLE GLAND

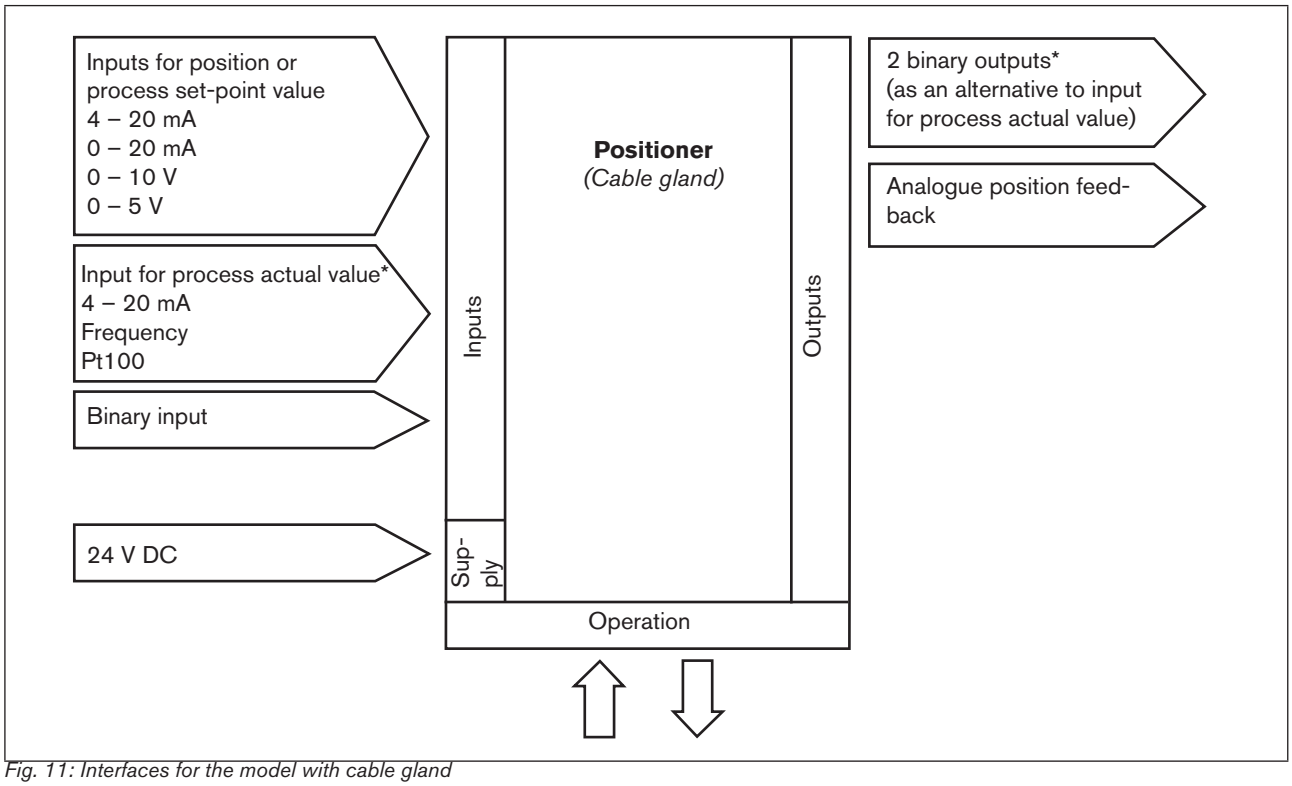

Fig. 11: Interfaces for the model with cable gland

The positioners Type 8692 and Type 8693 are 3-wire devices, i.e. the power (24 V DC) is supplied separately from the set-point value signal.

*Type 8693: The switch can be used to supply power to a connected sensor

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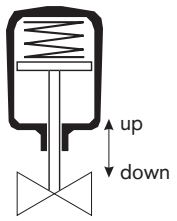
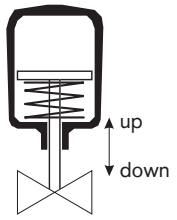
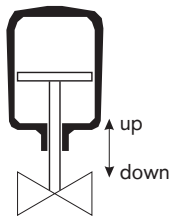
7 TECHNICAL DATA

7.1 Safety positions after failure of the electrical or pneumatic auxiliary power

Actuator system	Designation	Safety positions after failure of the auxiliary power	
		electrical	pneumatic
	single-acting control function A	down	down
	single-acting control function B	up	up
	double-acting control function I	down / up (depending on the connection of the control cables)	not defined

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7.2 Factory settings of the positioner

Function	Factory setting	Function	Factory setting
ACTUATOR	*SINGLE* or *DOUBLE**	*X.CONTROL*	
INPUT	*4-20 mA*	*DBND*	*1.0 %*
CHARACT	*linear*	*KXopn*	(1) Values of *X.TUNE* determined
DIR.CMD	*Rise*	*KXcls*	(1) Values of *X.TUNE* determined
CUTOFF	*Min 0 %* *Max 100 %*	After executing of *SET.FACTORY: 1*	
DIR.ACT	*Rise*	*SECURITY*	
SPLTRNG	*Min 0 %* *Max 100 %*	*Access Code 1*	*0000*
X.LIMIT	*Min 0 %* *Max 100 %*	*SAFEPOS*	*0 %*
X.TIME		*SIG.ERROR*	
Open	*(1s)* Values of *X.TUNE* determined	*SP/CMD Input*	*Error off*
Close	*(1s)* Values of *X.TUNE* determined	*P.CONTROL*	
After executing of *SET.FACTORY: 1s*		*PARAMETER*	
OUTPUT		*DBND*	*1.0 %*
OUT ANALOG	*Out POS*	*KP*	*1.00*
	OUT type 4-20 mA	*TN*	*999.9*
OUT BIN1	*Out DEV.X*	*TV*	*0.0*
	Lim. DEV.X 1.0 %	*X0*	*0.0 %*
	OUT.BIN1 type normally opened	*FILTER*	*0*
OUT BIN2	*Out DEV.X*	*SETUP*	
	Lim. DEV.X 1.0 %	*SP-INPUT*	*intern*
	OUT.BIN1 type normally opened	*PV-INPUT*	*4-20 mA*
		PV-SCALE	*PVmin 0.0*
BINARY. IN	*SafePos*	*PV-SCALE*	*PVmax 100.0*
BIN. IN type	*normally opened*	*P.CO-INIT*	*standard*

* *preset at the factory according to the actuator*

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7.3 Specifications of the Positioner

7.3.1 Operating Conditions

CAUTION!

If used outside, the device may be exposed to direct sunlight and temperature fluctuations which may cause malfunctions or leaks!

- The device must not be used outside.

Ambient temperature	0 - + 55 °C
Protection type	IP 65 in accordance with EN 60529 (only if cables, plugs and sockets have been connected correctly)

7.3.2 Conformity with the following standards

CE conforms to EMC Directive 2004/108/EC (until now: 89/336/EEC)
(only if cables, plugs and sockets have been connected correctly)

7.3.3 Mechanical data

Dimensions	see data sheet
Body material	exterior: PPS, PC, VA, interior: PA 6; ABS
Sealing material	NBR / EPDM

7.3.4 Electrical data

Connections	cable entry (24 V DC) or multi-pole plug (Profibus DP, DeviceNet, 24 V DC)
Power supply	24 V DC ± 10 % max. residual ripple 10 %
Power input	< 5 W
Input resistance for actual value signal	180Ω at 4 - 20 mA / 12 bit resolution 17 kΩ at frequency, 0 – 1000 Hz / 1‰ of measured value > 300 mV_{ss} sine, square, triangle PT 100 - 20 – + 220 °C, resolution < 0.1 °C
Input resistance for nominal value signal	180 Ω at 0/4 - 20 mA / 12 bit resolution 19 kΩ at 0 - 5/10 V / 12 bit resolution
Protection class	3 in accordance with VDE 0580
Analogue position feedback max. current for voltage output 0 – 5/10 V max. load for current output 0/4 – 20 mA	 10 mA 560 Ω
Inductive proximity switches current limitation	 100 mA
Binary outputs Current limiting	galvanically isolated 100 mA, output is clocked
Binary input	galvanically isolated 0 – 5 V = log "0", 10 – 30 V = log "1" input inverted accordingly

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7.3.5 Pneumatic Data

Control medium	Quality classes in accordance with DIN ISO 8573-1
Dust content	Class 5 max. particle size 40 µm, max. particle density 10 mg/m³
Water content	Class 3 max. pressure dew point - 20 °C or min. 10 degrees below the lowest operating temperature
Oil content	Class 5 max. 25 mg/m³
Temperature range of the compressed air	0 - + 50 °C
Pressure range	3 - 7 bar
Air output, control valve	7 l_N / min (for aeration and deaeration) (Q_{Nn} value according to definition for pressure drop from 7 to 6 bar absolute)
	Optional: 130 l_N / min (for aeration and deaeration) (only single-acting)
Connections	Plug-in hose connector Ø6mm / 1/4” On request: Socket connection G1/8

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Control and display elements, operating modes

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1 CONTROL AND DISPLAY ELEMENTS

The following chapter describes the control and display elements of the positioner.

Further information on the control of the positioner can be found in the chapters entitled *"Installation"*, *"Start-up and operation of the position controller Type 8692"* and *"Start-up and operation of the process controller Type 8693"*.

1.1 Control and display elements of the positioner

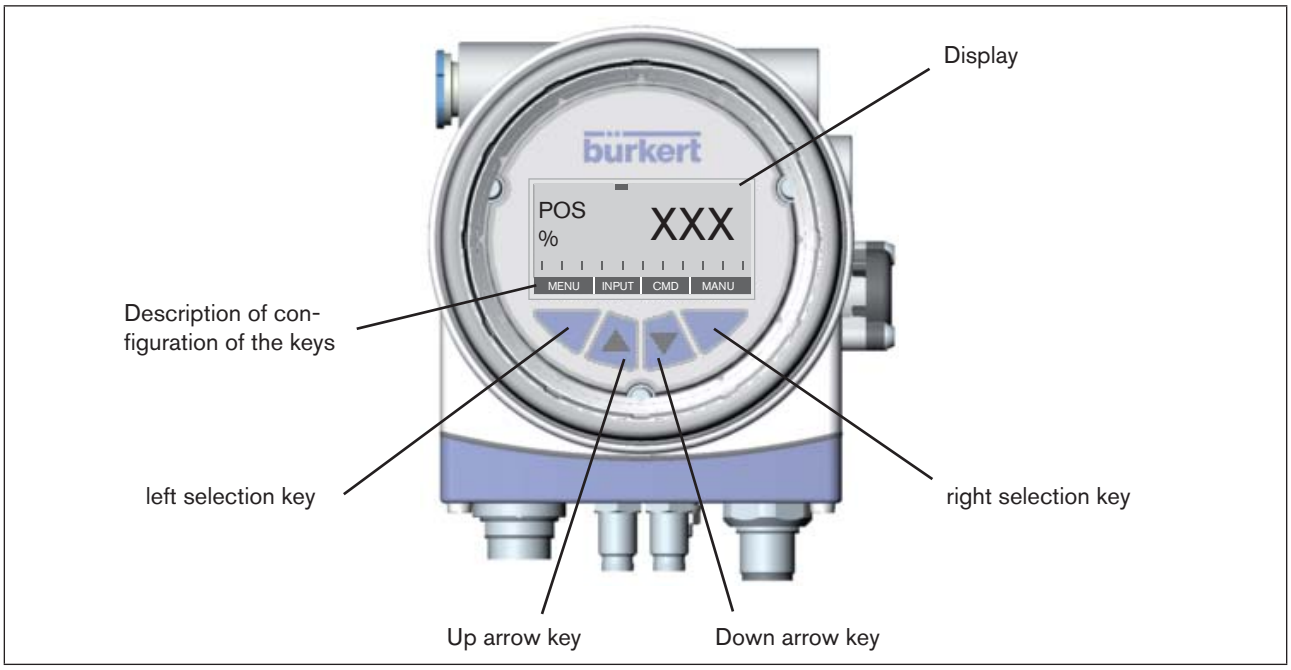

Fig. 1: Description of the control module

The positioner features a 4-key control panel and a 128x64 dot matrix graphics display as a display element.

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1.2 Configuration of the keys

The assignment of the 4 keys on the control panel differs depending on the operating status (AUTOMATIC / MANUAL) or operating level (Operate process / Parameterization and Configuration) of the positioner.

The configuration of the keys is represented in the lower grey bar on the display panel.

The description of the operating statuses (AUTOMATIC / MANUAL) and the operating levels (Operate process / Parameterization and Configuration) can be found in the chapters entitled *"Operating modes"* and *"Operating levels"*.

Key	Configuration (indicated in the lower bar)	Operating status / Operating level
Up / down arrow key	Change the display (e.g. *POS-CMD-TEMP-...*)	AUTOMATIC / Operate process
	OPN - CLS (OPEN - CLOSE) manual opening and closing of the actuator	MANUAL / Operate process
	Scroll up and down the menus	AUTOMATIC or MANUAL / Parameterization or Configuration
	+ and - increase or reduce numerical values	AUTOMATIC or MANUAL / Parameterization or Configuration
	+ and ← adjust numerical values by individual digits	AUTOMATIC or MANUAL / Parameterization or Configuration
Left selection key	Switch to the Parameterization level (MENU) Note: the key must be pressed for approx. 3s (Count-down: 2 bars converge on the display panel)	AUTOMATIC or MANUAL / Operate process
	EXIT (BACK) Operate process on the operating level	AUTOMATIC or MANUAL / Parameterisation
	EXIT (BACK) from a menu option on the operating level Param-eterization or Configuration	AUTOMATIC or MANUAL / Parameterization or Configuration
	ESC Leave a menu	AUTOMATIC or MANUAL / Parameterization or Configuration
	STOP End a sequence	AUTOMATIC or MANUAL / Parameterization or Configuration
Right selection key	Switch between AUTOMATIC and MANUAL mode	Operate process
	Select, activate or deactivate a menu option (ENTER, SELEC, OK, INPUT)	AUTOMATIC or MANUAL / Parameterization or Configuration
	EXIT (BACK) from a menu option on the operating level Param-eterization or Configuration	AUTOMATIC or MANUAL / Parameterization or Configuration
	RUN Start a sequence	AUTOMATIC or MANUAL / Parameterization or Configuration
	STOP End a sequence	AUTOMATIC or MANUAL / Parameterization or Configuration

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1.3 Information on the Display

The following representation describes the information on the display:

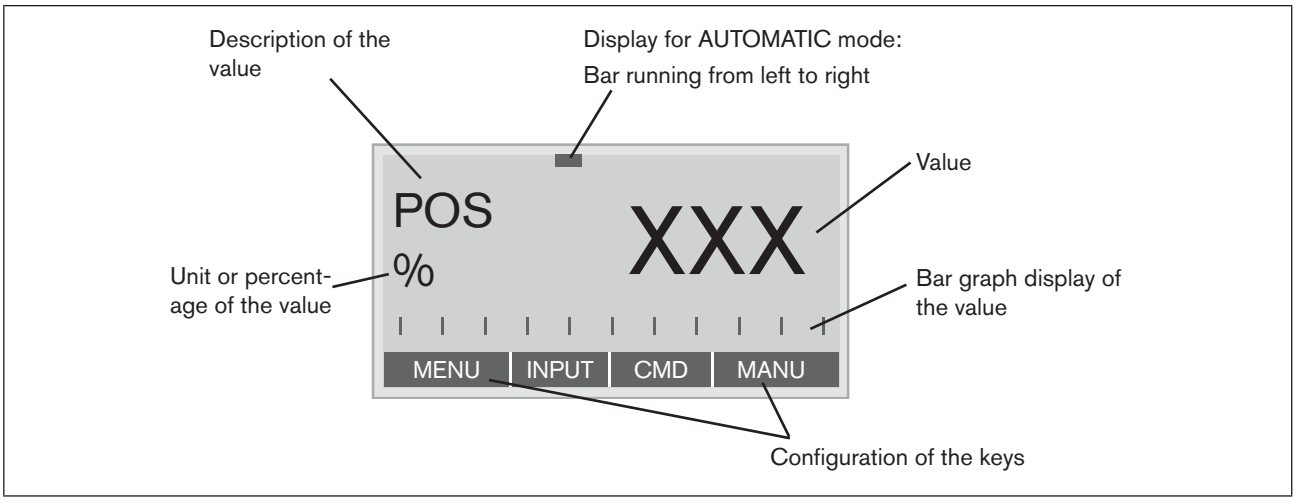

Fig. 2: Description of display

List of values which can be displayed in AUTOMATIC mode:

Representation of value	Unit, value range	Description
POS	%	Display of actual position of the valve actuator
CMD	%	Display of nominal position of the valve actuator
TEMP	°C	Internal temperature in the housing of the positioner
INPUT	mA, V	Input signal for nominal position
PV (PROCESS VALUE)	bar, mbar, psi, %, mm, litre l/s, l/min, l/h, m³/min, m³/h, UG/s, UG/min, UG/h, IG/s, IG/min, IG/h °C, °F	Process actual value, 4 – 20 mA input Process actual value, Frequency input Process actual value, PT100 input
SP (SETPOINT)	bar, mbar, psi, %, mm, litre l/s, l/min, l/h, m³/min, m³/h, UG/s, UG/min, UG/h, IG/s, IG/min, IG/h °C, °F *	Process set-point value

* *Unit depending on process actual value.*

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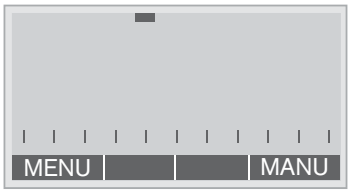
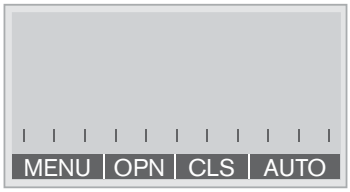
2 OPERATING MODES

2.1 Operating state

The positioner has 2 operating states: AUTOMATIC and MANUAL mode.



AUTOMATIC — Normal controller mode is implemented and monitored in AUTOMATIC operating state.
(A bar runs along the upper edge of the display).



MANUAL — In MANUAL operating state the valve can be opened and closed manually via the arrow key (OPN/CLS).
(No bar running along the upper edge of the display).

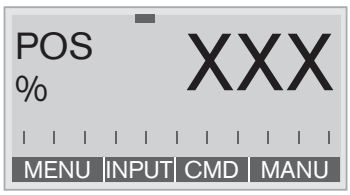
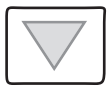
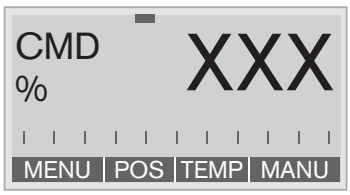
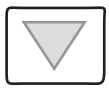
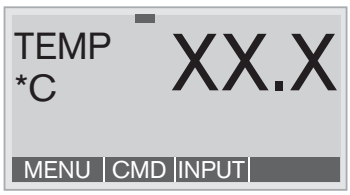
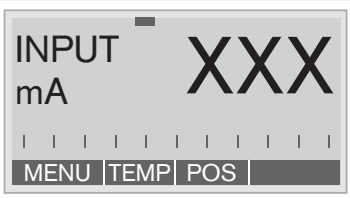
The right selection key can be used to switch between the two operating states AUTOMATIC (AUTO) and MANUAL (MANU).

It is possible to switch from AUTOMATIC to MANUAL mode only on the *POS* and *CMD* displays and also on the *PV* display for Type 8693. On the *SP* display only for external process set-point value (see also Configuration of the keys).

2.2 AUTOMATIC Operating State for Type 8692

(Bar runs along the upper edge of the display from left to right)
Normal controller mode is implemented and monitored in AUTOMATIC operating state.

The arrow keys can be used to switch between the following displays in AUTOMATIC operating state:

		Display of actual position of the valve actuator (0 - 100%)
		▪ Display of nominal position of the valve actuator or ▪ Display of nominal position of the valve actuator after rescaling by possibly activated split range function or correction characteristic (0 - 100%)
		Internal temperature in the housing of the positioner (°C)
		Input signal for nominal position (0 - 5/10 V or 0/4 – 20 mA)

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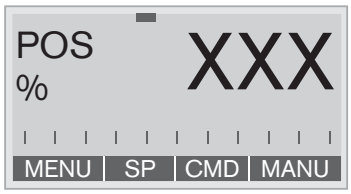
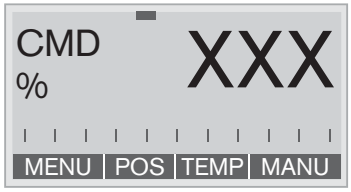
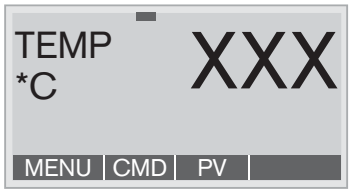
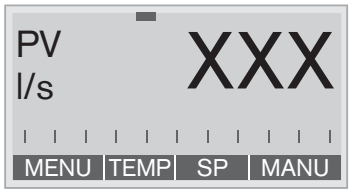
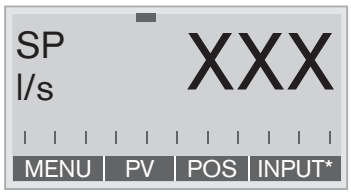
2.3 AUTOMATIC Operating State for Type 8693

(Bar runs along the upper edge of the display from left to right)

Normal controller mode is implemented and monitored in AUTOMATIC operating state.

If the *P.CONTROL* additional function is activated for Type 8693, it is possible to switch between the following states in AUTOMATIC operating state:

		Display of actual position of the valve actuator (0 - 100%)
		▪ Display of nominal position of the valve actuator or ▪ Display of nominal position of the valve actuator after rescaling by possibly activated split range function or correction characteristic (0 - 100%)
		Internal temperature in the housing of the positioner (°C)
		Process actual value
		Process set-point value

If the *P.CONTROL* additional function is not active, the displays are represented as under Type 8692.

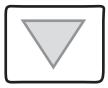
* *INPUT is indicated here if the internal nominal value default has been selected (P.CONTROL - SP-INPUT - internal).*
MANU is indicated here if the external nominal value default has been selected (P.CONTROL - SP-INPUT - external).

2.4 MANUAL Operating State

(no bar running along upper edge of display)

In MANUAL operating state the valve can be opened and closed manually via the arrow keys.

Meaning of the arrow keys in MANUAL operating state:

	Press the up arrow key: Aerate the actuator Control function A (SFA): Valve opens Control function B (SFB): Valve closes Control function I (SFI): Connection 2.1 aerated
	Press the down arrow key: Deaerate the actuator Control function A (SFA): Valve closes Control function B (SFB): Valve opens Control function I (SFI): Connection 2.2 aerated

SFA: Actuator closes by spring force
SFA: Actuator opens by spring force
SFI: Actuator double-acting

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3 OPERATING LEVELS

The menu structure in the control module of the positioner contains 2 operating levels:

- **Level 1:** **Operate process**
  - Operating mode AUTOMATIC → Process / input data displayed
  - MANUAL → Actuator opened and closed manually
- **Level 2:** **Parameterization and Configuration**
  - Input operating parameters
  - Supplement the menu with optional menu options

3.1 Switching between the Operating Levels

If AUTOMATIC operating mode has been set when switching from level 1 (Operate process) to level 2 (Parameterization and Configuration), the process continues running while positioner settings are implemented on level 2.

→ To switch from level 1 (Operate process) to level 2 (Parameterisation), press the selection key on the left (MENU) for approx. 3 seconds.During these 3 seconds (Countdown) 2 bars converge (see Fig. 3).

→ To switch back from level 2 (Parameterization and Configuration) to level 1 (Operate process), press the selection key on the left (EXIT).

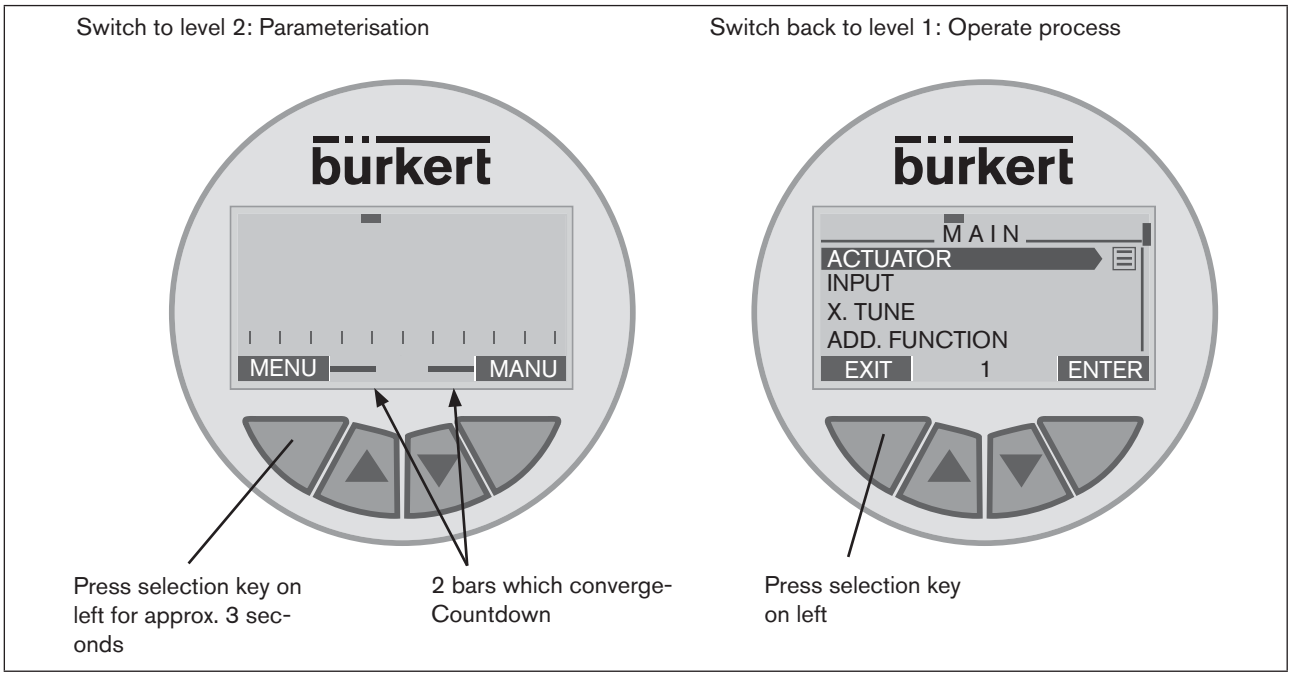

Fig. 3: Switch operating level

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Installation

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1 INSTALLING THE VALVE

1.1 Safety Instructions

DANGER!

Danger – high pressure in the equipment!

There is a serious risk of injury when reaching into the equipment.

- Before loosening the lines and valves, turn off the pressure and vent the lines.

WARNING!

Danger - improper installation!

Improper installation may result in injuries as well as damage to the device and the area around it.

- Fluid and electrical installations may be carried out by authorized technicians only and with the appropriate tools!

Danger due to unintentional activation of the equipment!

Unintentional activation of the equipment during installation may result in injuries and damage.

- Take appropriate measures to prevent the equipment from being unintentionally activated.

The positioner dimensions and the different complete device models consisting of positioner, pneumatic actuator and valve can be found on the data sheet.

1.2 installation of the process valve

Thread type and dimensions can be found in the corresponding data sheet.

→ Connect the valve according to the operating instructions for the valve.

2 ROTATING THE ACTUATOR MODULE

The actuator module cannot be rotated unless there are straight seat and slanted seat valves!

Following installation of the process valve, if the positioner display is only partially visible or the connection cables or hoses cannot be fitted properly, the actuator module (positioner and actuator) can be rotated into a position suitable for the connection.

Only the entire actuator module can be rotated. The positioner cannot be rotated contrary to the actuator.

Procedure:

→ Clamp the valve housing in a retaining jig (only possible if the process valve has not yet been installed).

→ Using a suitable open-end wrench, counter the wrench flat on the pipe.

→ Fit special key* exactly into the key contour on the underside of the actuator module.

WARNING!

Risk of injury from discharge of medium and pressure!

If the direction of rotation is wrong, the housing interface may become detached.

Do not rotate the actuator module in a clockwise direction!

→ Rotate the actuator module in an anti-clockwise direction into a position suitable for the pneumatic connection.

** The special key is available from your Bürkert sales office.*

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3 FLUID CONNECTION OF THE POSITIONER

DANGER!

Danger – high pressure in the equipment!

There is a serious risk of injury when reaching into the equipment.

- Before loosening the lines and valves, turn off the pressure and vent the lines.

WARNING!

Danger - improper installation!

Improper installation may result in injuries as well as damage to the device and the area around it.

- Fluid and electrical installations may be carried out by authorized technicians only and with the appropriate tools!

Danger due to unintentional activation of the equipment!

Unintentional activation of the equipment during installation may result in injuries and damage.

- Take appropriate measures to prevent the equipment from being unintentionally activated.

Fig. 1: Fluid Installation

Procedure:

→ Apply the supply pressure to connection "1" (3 – 7 bar; instrument air, free of oil, water and dust)

→ Attach the exhaust air line or the silencer to connection “3”

Keep the adjacent supply pressure **always** at least 0.5 – 1 bar above the pressure which is required to move the pneumatic actuator to its end position. This ensures that the control behavior is not extremely negatively affected in the upper stroke range on account of too little pressure difference.

During operation keep the fluctuations of the supply pressure as low as possible (max. ±10 %). If fluctuations are greater, the control parameters measured with the *X.TUNE* function are not optimum.

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4 ELECTRICAL CONNECTION - MULTIPOLE PLUG MODEL

DANGER!

Danger - electrical voltage in the equipment!

There is a serious risk of injury when reaching into the equipment.

- Before starting work, always switch off the power supply and safeguard to prevent re-activation!

WARNING!

Danger - improper installation!

Improper installation may result in injuries as well as damage to the device and the area around it.

- Fluid and electrical installations may be carried out by authorized technicians only and with the appropriate tools!

Danger due to unintentional activation of the equipment!

Unintentional activation of the equipment during installation may result in injuries and damage.

- Take appropriate measures to prevent the equipment from being unintentionally activated.

Using the 4 - 20 mA nominal value input

If the operating voltage of one positioner device fails in a series connection of several devices, the input of the failed positioner device becomes highly resistive. As a result, the 4 - 20 mA standard signal fails. In this case please contact Bürkert Service directly.

If PROFIBUS DP or DeviceNet: The designation of the multipole plugs and sockets and the contacts can be found in the respective chapters.

4.1 Type 8692 - Designation of the multipole plugs and the contacts

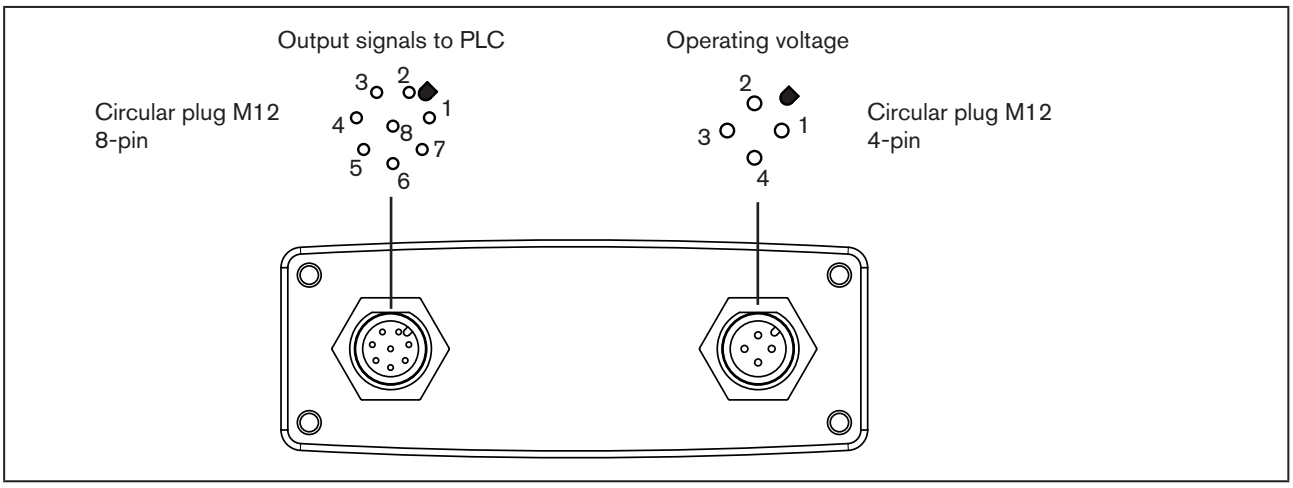

Fig. 2: Designation of the multipole plugs and contacts 8692

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4.2 Connection of the Position Controller Type 8692

4.2.1 Input signals of the control centre (e.g. PLC) - circular plug M 12 - 8-pole

Pin	Configuration	external circuit / signal level
8	Set-point value + (0/4 – 20 mA or 0 – 5 / 10 V)	8 ——— + (0/4 - 20 mA or 0 - 5 / 10 V) completely galvanically isolated
7	Set-point value GND	7 ——— GND
1	Binary input + (only optional)	1 ——— + 0 - 5 V (log. 0) / 10 - 30 V (log. 1)

4.2.2 Output signals to the control centre (e.g. PLC) - circular plug M 12 - 8-pole (required for Analogue output and/or Binary output option only)

→ Connect the pins according to the design (options) of the positioner.

Pin	Configuration	external circuit / signal level
6	Analogue position feedback +	6 ——→ + (0/4 - 20 mA or 0 - 5 / 10 V) completely galvanically isolated
5	Analogue position feedback GND	5 ——→ GND
4	Binary output 1	4 ——→ 24 V / 0 V
3	Binary output 2	3 ——→ 24 V / 0 V
2	Binary outputs GND	2 ——→ GND

4.2.3 Operating voltage (circular plug M 12 - 4-pole)

Pin	Configuration	External circuit
1	+ 24 V	1 ——— 24 V DC ± 10 % max. residual ripple 10 %
2	not assigned	
3	GND	3 ———
4	not assigned	

When the power supply voltage is applied, the positioner is operating.

→ Now implement the required basic settings and activate automatic adjustment of the positioner as described in the chapter entitled *"Initial Start-up"* or *"Starting and Setting Up the Position Controller Type 8692"*.

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4.3 Type 8693 - Designation of the multipole plugs and the contacts

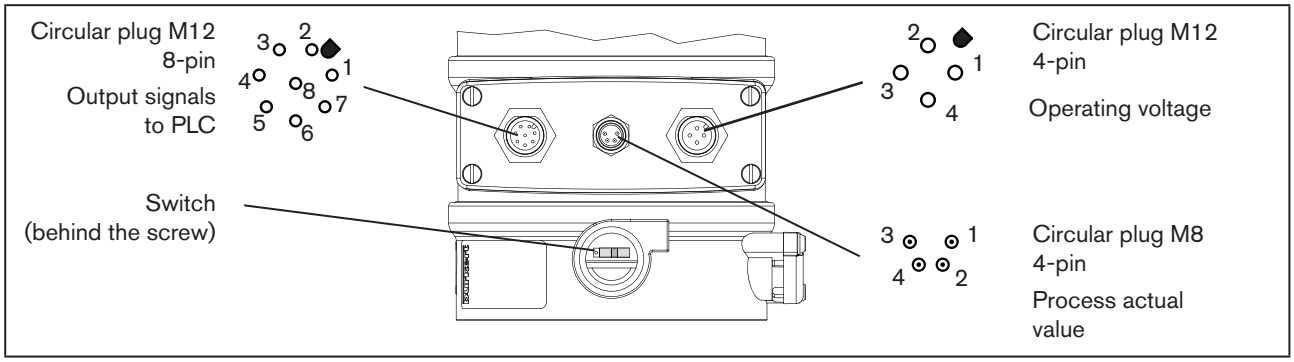

Fig. 3: Designation of the multipole plugs and contacts 8693

4.4 Connection of the Process Controller Type 8693

→ First connect the process controller as described in the chapter entitled "4.2 Connecting the Position Controller Type 8692".

4.4.1 Process Actual Value (circular plug M 8)

Input type*	Pin	Configuration	Switch	External circuit
4 – 20 mA - internally supplied	1 2 3 4	+ 24 V transmitter supply Output from transmitter GND Bridge after GND (GND from 3-wire transmitter)	Switch on left	1 → Transmitter 2 3 GND 4
4 – 20 mA - externally supplied	1 2 3 4	Not assigned Process actual + Not assigned Process actual -	Switch on right	2 — 4 ... 20 mA 4 — GND
Frequency - internally supplied	1 2 3 4	+ 24 V sensor supply Clock input + Clock input - (GND) Not assigned	Switch on left	1 — + 24 V 2 — Clock + 3 — Clock -
Frequency - externally supplied	1 2 3 4	Not assigned Clock input + Clock input - Not assigned	Switch on right	2 — Clock + 3 — Clock -
Pt 100 (see information below)	1 2 3 4	Not assigned Process actual 1 (current feed) Process actual 2 (GND) Process actual 3 (compensation)	Switch on right	2 — Pt 100 3 4

For reasons of wire compensation connect the Pt 100 sensor via 3 wires. Always bridge Pin 3 and Pin 4 on the sensor.

When the power supply voltage is applied, the positioner is operating.

→ Now implement the required basic settings and activate automatic adjustment of the positioner as described in the chapter entitled *"Initial Start-up"* or *"Starting and Setting Up the Process Controller Type 8693"*.

* *Can be adjusted by software (see chapter entitled "Specifying the Basic Settings")*

5 ELECTRICAL CONNECTION - TERMINAL MODEL FOR CABLE GLAND

DANGER!

Danger - electrical voltage in the equipment!

There is a serious risk of injury when reaching into the equipment.

- Before starting work, always switch off the power supply and safeguard to prevent re-activation!

WARNING!

Danger - improper installation!

Improper installation may result in injuries as well as damage to the device and the area around it.

- Fluid and electrical installations may be carried out by authorized technicians only and with the appropriate tools!

Danger due to unintentional activation of the equipment!

Unintentional activation of the equipment during installation may result in injuries and damage.

- Take appropriate measures to prevent the equipment from being unintentionally activated.

Using the 4 - 20 mA nominal value input

If the operating voltage of one positioner device fails in a series connection of several devices, the input of the failed positioner device becomes highly resistive. As a result, the 4 - 20 mA standard signal fails. In this case please contact Bürkert Service directly.

5.1 Terminal board of the positioner with screw-type terminals and switches

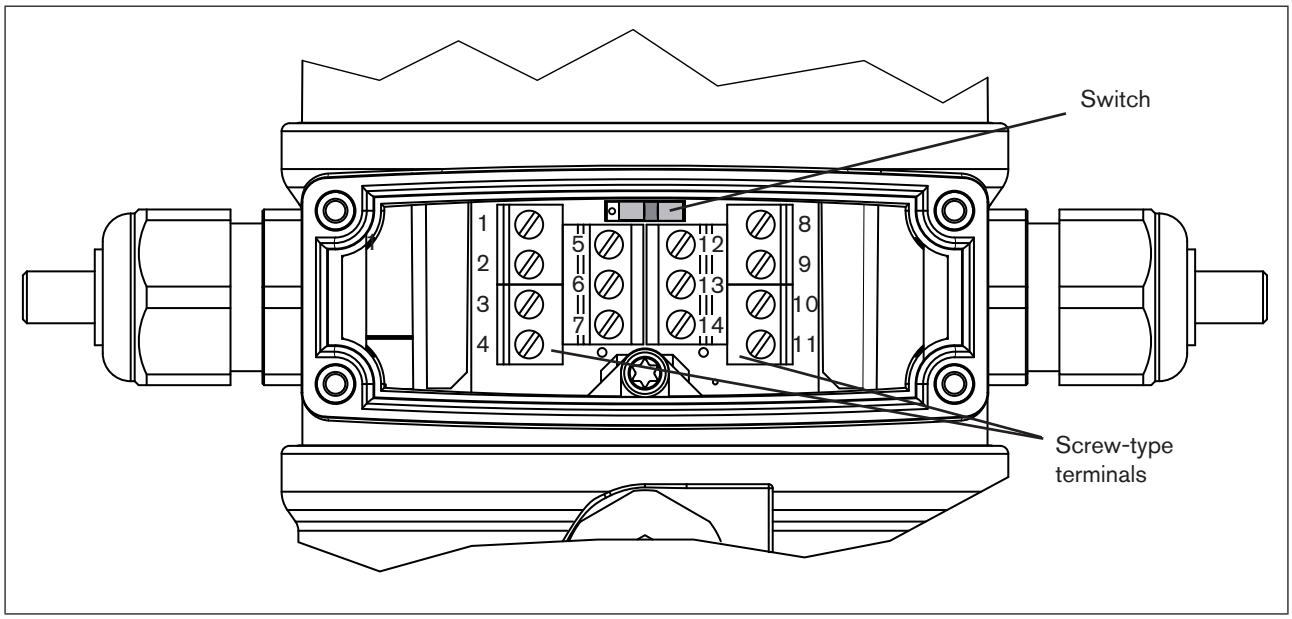

Fig. 4: Terminal board with switch

→ The connection terminals can be accessed by removing the cover from the cable glands. To do this, unscrew the 4 screws.

→ Connect the positioner accordingly:

Type 8692: see chapter entitled *"Terminal Assignment for Cable Gland - Position Controller Type 8692"*

Type 8693: see chapter entitled *"Terminal Assignment for Cable Gland - Process Controller Type 8693"*

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5.2 Terminal Assignment for Cable Gland - Position Controller Type 8692

5.2.1 Input Signals from the Control Centre (e.g. PLC)

Terminal	Configuration	External circuit
11	Set-point value +	11 ○——— + (0/4 – 20 mA or 0 – 5 / 10 V)
10	Set-point value GND	10 ○——— GND
12	Binary input + (optional only)	12 ○——— + ⟍ 0 – 5 V (log. 0) 10 – 30 V (log. 1)
13	Binary input GND (optional only)	13 ○——— GND

5.2.2 Output signals to the control centre (e.g. PLC) (required for Analogue output and/or Binary output option only)

→ Connect the terminals according to the design (options) of the positioner.

Terminal	Configuration	External circuit
9	Analogue position feedback +	9 ○——→ + (0/4 – 20 mA or 0 – 5 / 10 V) completely galvanically isolated
8	Analogue position feedback GND	8 ○——→ GND
5	Binary output 1	5 ○——— 24 V / 0 V NC / NO
6	Binary output GND	6 ○——— GND
7	Binary output 2	7 ○——— 24 V / 0 V NC / NO
6	Binary output GND	6 ○——— GND

5.2.3 Operating Voltage

Terminal	Configuration	External circuit
14	Operating voltage +	14 ○——┐ 24 V DC ± 10 %max. residual ripple 10 %
13	Operating voltage GND	13 ○——┘

When the power supply voltage is applied, the positioner is operating.

→ Now implement the required basic settings and activate automatic adjustment of the positioner as described in the chapter entitled *"Initial Start-up"* or *"Starting and Setting Up the Position Controller Type 8692"*.

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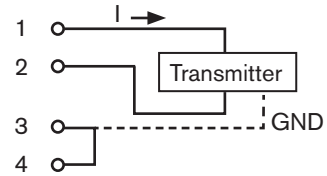
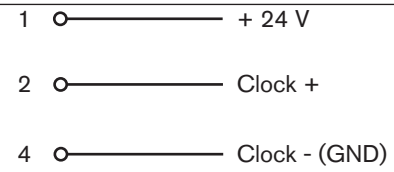
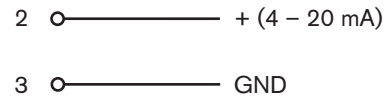
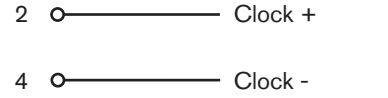
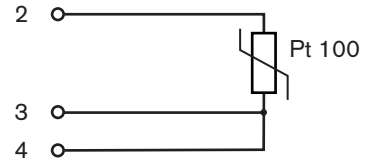
5.3 Terminal Assignment for Cable Gland - Process Controller Type 8693

→ First connect the process controller as described in the chapter entitled "*5.2 Terminal Assignment for Cable Gland - Position Controller Type 8692*".

5.3.1 Terminal Assignment when Selecting the Process Actual Value Input

Input type*	Switch**	Terminal	Configuration	External circuit
4 – 20 mA - internally supplied	Switch on left	1 2 3 4	+ 24 V transmitter input Transmitter output Bridge after GND (GND from 3-wire transmitter) GND	
Frequency - internally supplied		1 2 3 4	+ 24 V sensor supply Clock input + Not assigned Clock input - (GND)	
4 – 20 mA - externally supplied	Switch on right	1 2 3 4	Not assigned Process actual + Process actual - Not assigned	
Frequency - externally supplied		1 2 3 4	Not assigned Clock input + Not assigned Clock input -	
Pt 100 (see information below)		1 2 3 4	Not assigned Process actual 1 (current feed) Process actual 2 (GND) Process actual 3 (compensation)	

For reasons of wire compensation connect the Pt 100 sensor via 3 wires.
Always bridge Terminal 3 and Terminal 4 on the sensor.

When the power supply voltage is applied, the positioner is operating.

→ Now implement the required basic settings and activate automatic adjustment of the positioner as described in the chapter entitled *"Initial Start-up"* or *"Starting and Setting Up the Process Controller Type 8693"*.

* *Can be adjusted by software (see chapter entitled "Specifying the Basic Settings")*
** *The switch is situated on the terminal board of the positioner (see Fig. 4)*

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6 INITIAL START-UP

This section enables you to start up the positioner quickly in order to perform a function check. Additional functions which are not required are not dealt with in this context.

6.1 Safety Instructions

DANGER!

Danger – high pressure in the equipment!

There is a serious risk of injury when reaching into the equipment.

- Before loosening the lines and valves, turn off the pressure and vent the lines.

WARNING!

Danger - improper installation!

Improper installation may result in injuries as well as damage to the device and the area around it.

- Fluid and electrical installations may be carried out by authorized technicians only and with the appropriate tools!

Danger due to unintentional activation of the equipment!

Unintentional activation of the equipment during installation may result in injuries and damage.

- Take appropriate measures to prevent the equipment from being unintentionally activated.

6.2 Installation

→ Before start-up, carry out fluid and electrical installation of the positioner and valve.

When the operating voltage is applied, the positioner is operating and is in the AUTOMATIC operating state.

6.3 Specifying the Basic Settings

The basic settings of the positioner are implemented at the factory.

Before the positioner can undergo a function check, the unit input signal (standard signal) must still be set following installation of the device and the *X.TUNE* function run to adjust the device to local conditions.

To specify the basic settings, switch from the process operating level to the configuration level.

→ Hold down the left selection key (MENU) for approx. 3 seconds (countdown: two bars converge on the display). Then the main menu (MAIN) is indicated on the display together with the menu options which can be individually marked via the arrow keys and then selected via the right selecion key (ENTER).

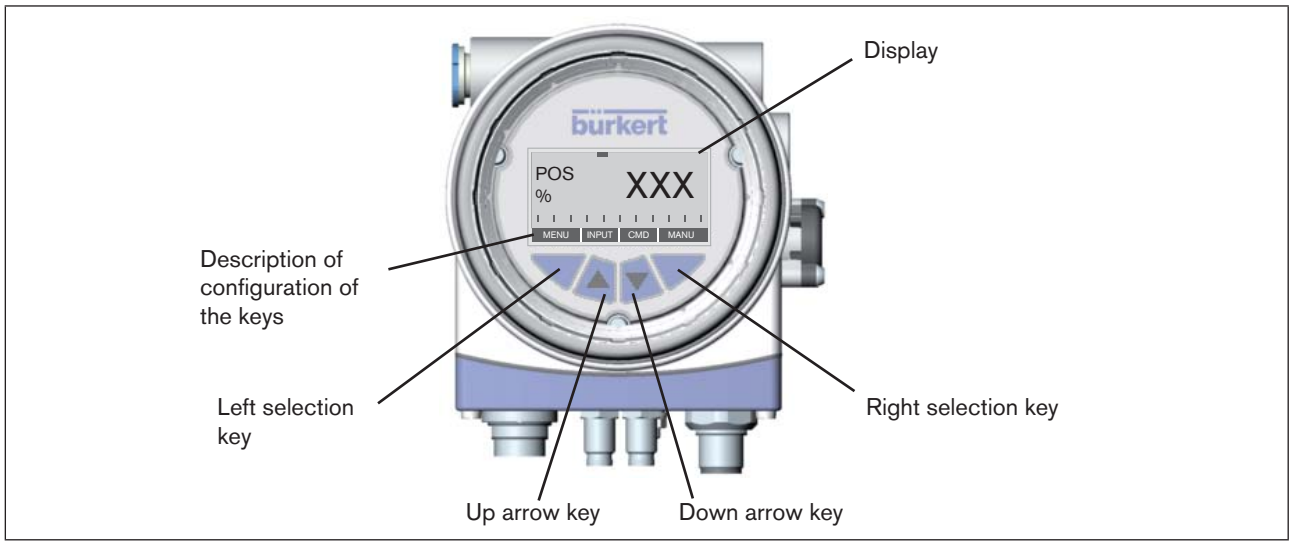

Fig. 5: Description of the control module

An overview of the operating structure of the basic settings can be found in the chapter entitled *"Overview of Operating Structure – Initial Start-up"* .

6.3.1 Setting the Input Signal (Standard Signal):

→ Using the arrow keys, mark the *INPUT* menu option in the main menu and then press the right selection key (ENTER) to enter the *INPUT* submenu.

→ Using the arrow keys, mark the input signal (4-20mA, 0-20mA,...).

→ Press the right selection key (SELEC) to select the input signal (dot is marked).

→ To leave the submenu, press the left selection button (EXIT).

→ To leave the main menu, press the left selection button (EXIT) again.

You have to leave the main menu by pressing the left selection button (EXIT) before the modified data is saved in the memory (EEPROM). During the save process the message "*SAVE EEPROM*" is indicated on the display.

6.3.2 Running the Automatic Adjustment *X.TUNE*:

An exact description of the *X.TUNE* function can be found in the chapters entitled *"Start-up and Operating the Position Controller Type 8692"*

WARNING!

While the *X.TUNE* function is running, the valve automatically moves from its current position!

- Never run *X.TUNE* while a process is running!
- Take appropriate measures to prevent the equipment from being accidentally actuated!

CAUTION!

Avoid maladjustment of the controller due to an incorrect supply pressure or applied operating medium pressure!

- Run *X.TUNE* **whenever** the supply pressure (= pneumatic auxiliary energy) is available during subsequent operation.
- Run the *X.TUNE* function preferably **without** operating medium pressure to exclude interference caused by flow forces.

→ To enter the main menu, hold down the left selection button (MENU) for approx. 3s (countdown on the display).

→ Using the arrow buttons, mark the *X.TUNE*menu option.

→ To start the automatic adjustment *X.TUNE* , hold down the right selection button (RUN) for approx. 3s (countdown on the display).

While the automatic adjustment is running, messages on the progress of the *X.TUNE* (e.g. *"TUNE #1...."*) are indicated on the display.

When the automatic adjustment completes, the message *"X.TUNE READY"* is indicated.

→ Press any key to return to the main menu.

→ To leave the main menu, press the left selection button (EXIT).

You have to leave the main menu by pressing the left selection button (EXIT) before the modified data is saved in the memory (EEPROM). During the save process the message "*SAVE EEPROM*" is indicated on the display.

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6.3.3 Overview of Operating Structure Initial Start-up

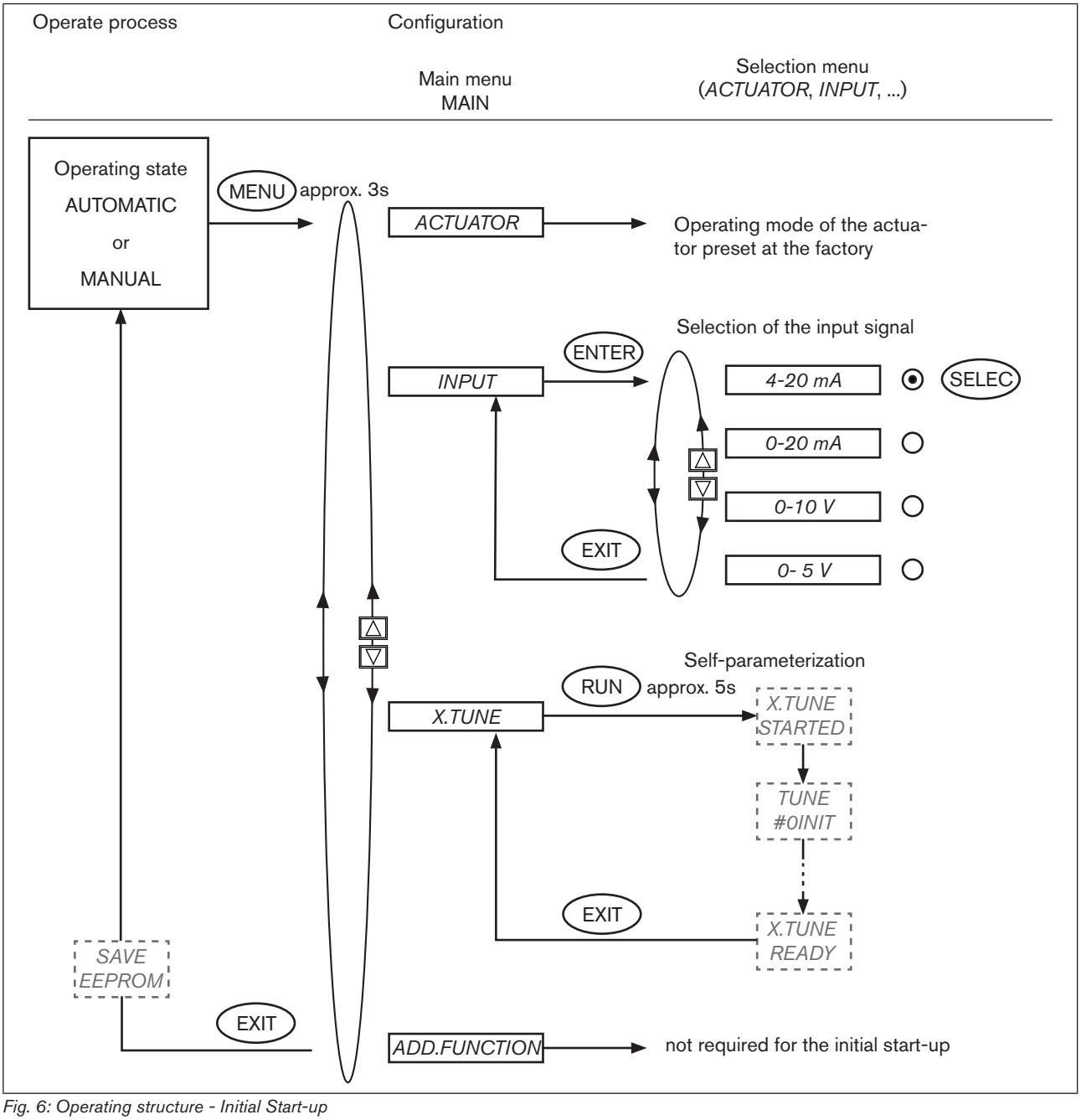

Fig. 6: Operating structure - Initial Start-up

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Start-up and operation of the position controller Type 8692

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1 SAFETY INSTRUCTIONS

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- Before loosening the lines and valves, turn off the pressure and vent the lines.

WARNING!

Danger - improper installation!

Improper installation may result in injuries as well as damage to the device and the area around it.

- Fluid and electrical installations may be carried out by authorised technicians only and with the appropriate tools!

Danger due to unintentional activation of the equipment!

Unintentional activation of the equipment during installation may result in injuries and damage.

- Take appropriate measures to prevent the equipment from being unintentionally activated.

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2 STARTING UP AND INSTALLING THE POSITION CONTROLLER TYPE 8692

→ Before starting up the device, carry out the fluid and electrical installations as described in the chapter entitled *"Installation"*.

2.1 Description of the procedure

When the operating voltage has been switched on, the positioner is at the process operating level in the AUTOMATIC operating state.

To specify the basic settings, you must switch to the configuration level:

→ Hold down the left selection key (MENU) for approx. 3 seconds (wait for countdown on display).

Then the main menu is indicated on the display (MAIN).

→ Press the arrow keys to switch between the main menu options and select a menu option with the right selection key (ENTER/RUN).

Depending on the function, a menu sub-option or a selection screen is indicated on the display.

→ Press the arrow keys to switch between these sub-options and select the required settings. Press the right selection key (SELEC/ENTER) to confirm the selection (the point after the selected parameter is now marked). Return to the main menu by pressing the left selection key (EXIT).

→ To save the changed settings, you must leave the configuration level by pressing the left selection key (EXIT).

You are back at the process operating level.

Only when you leave the configuration level by pressing the right selection key, are the changed parameters and settings saved (*"save EEPROM"*).

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2.2 Factory settings of the position controller

Function	Factory setting	Function	Factory setting
ACTUATOR	*SINGLE* or *DOUBLE**	*X.CONTROL*	
		DBND	*1.0 %*
INPUT	*4-20 mA*	*KXopn*	(1) Values of *X.TUNE* determined
		KXcls	(1) Values of *X.TUNE* determined
CHARACT	*linear*	After running *SET.FACTORY: 1*	
DIR.CMD	*Rise*	*SECURITY*	
		Access Code 1	*0000*
CUTOFF	*Min 0 %* *Max 100 %*	*SAFEPOS*	*0 %*
DIR.ACT	*Rise*	*SIG.ERROR*	
		SP/CMD Input	*Error off*
SPLTRNG	*Min 0 %* *Max 100 %*	*OUTPUT***	
		OUT ANALOGUE	*Out POS*
X.LIMIT	*Min 0 %* *Max 100 %*		*OUT type 4-20 mA*
		OUT BIN1	*Out DEV.X*
X.TIME			*Lim. DEV.X 1.0 %*
Open	*(1s)* Values of *X.TUNE* determined		*OUT.BIN1 type normally opened*
Close	*(1s)* Values of *X.TUNE* determined	*OUT BIN2*	*Out DEV.X*
After running *SET.FACTORY: 1s*			*Lim. DEV.X 1.0 %*
			OUT.BIN1 type normally opened
BINARY. IN	*SafePos*		
BIN. IN type	*normally opened*		

2.3 Specifying the Basic Settings

When starting up the positioner for the first time, implement the following basic settings:

→ Specify the selected unit signal input for the set-point value default (*INPUT*)
(4 – 20 mA, 0 – 20 mA, 0 – 10 V or 0 – 5 V).

→ Start automatic adjustment of the position controller to the particular operating conditions (*X.TUNE*).

The exact description of the functions *INPUT* and *X.TUNE* can be found in the chapter entitled "*Description of the functions of the main menu".*

The basic settings for the positioner are implemented at the factory. During start-up, however, it is essential to input the unit signal (*INPUT*) and run *X.TUNE* . Using the *X.TUNE* function, the positioner automatically determines the optimum settings for the current operating conditions.

If the *X.CONTROL* is in the main menu while the auxiliary function *X.TUNE* is running, the position controller dead band *DBND* is determined automatically depending on the friction behaviour of the actuator (see chapter entitled "*Auxiliary functions - X.CONTROL*")

* *preset at the factory*

** *option only*

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2.4 Description of the basic functions in the main menu

2.4.1 Main menu of the positioner

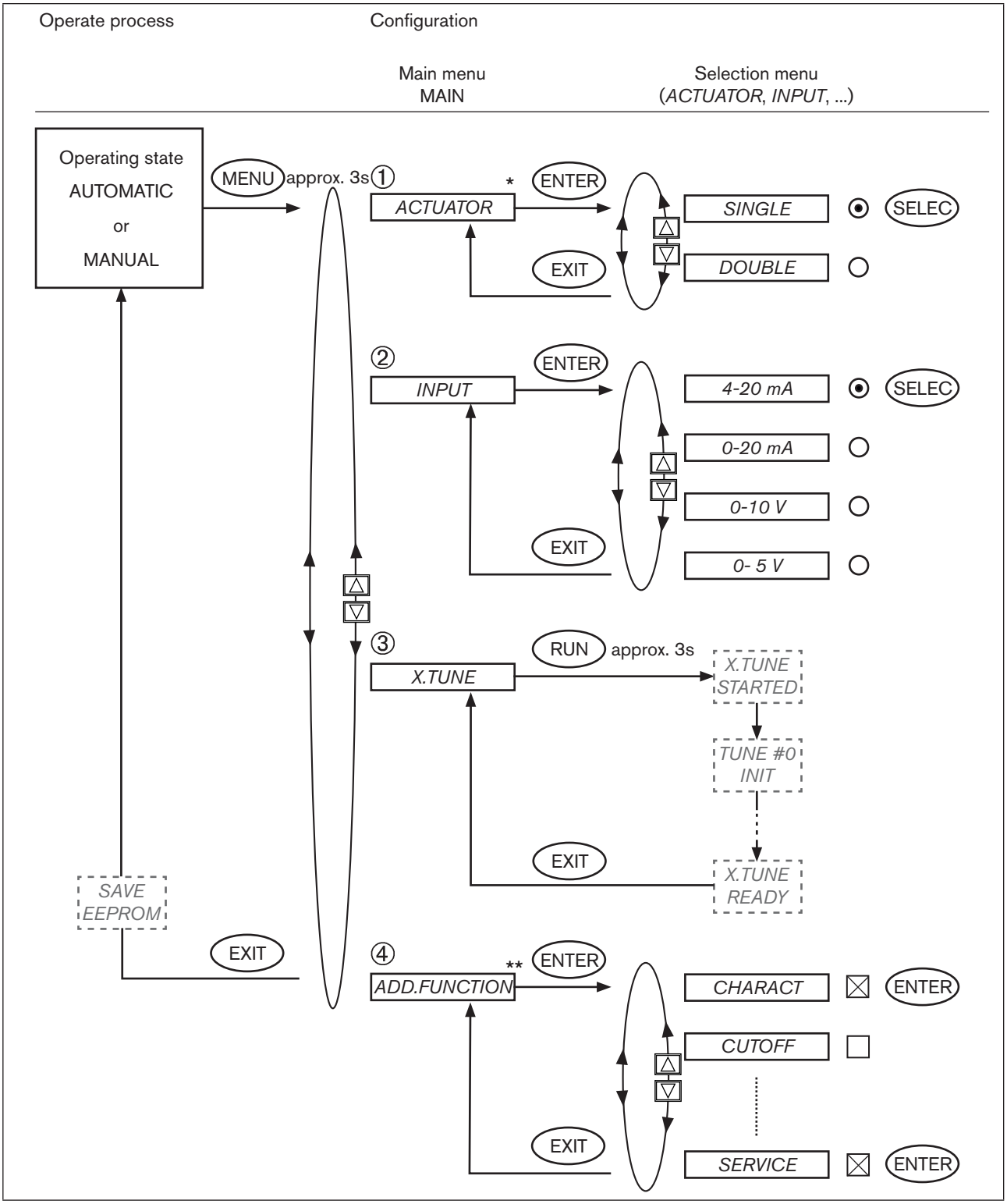

Fig. 1: Operating structure of basic settings

* *ACTUATOR: the operating mode of the actuator has been preset at the factory.*

** *ADD.FUNCTION is not required for the initial start-up.*

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2.4.2 Inputting the operating mode of the pneumatic actuator

① ***ACTUATOR*** - Operating mode of the actuator

The operating mode of the pneumatic valve actuator used in combination with the positioner can be input in this menu option.

The operating mode of the actuator has been preset at the factory.

SF A and SF B: single-acting
SF I: double-acting

The control function of the actuator can be found on the rating plate.

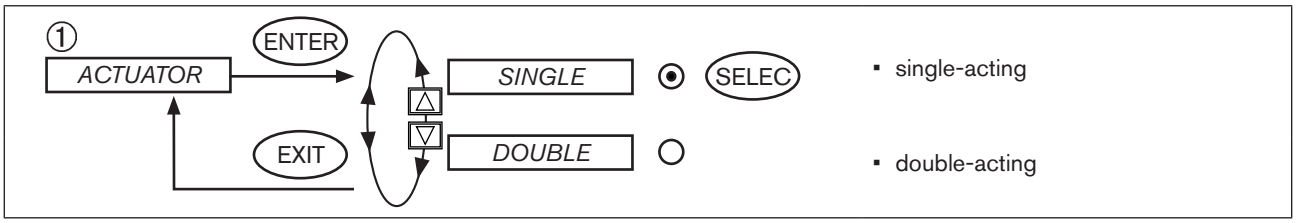

Fig. 2: Operating structure of ACTUATOR

2.4.3 Inputting the input signal

② ***INPUT*** - Selected unit input signal

→ Under this menu option input the unit signal used for the set-point value.

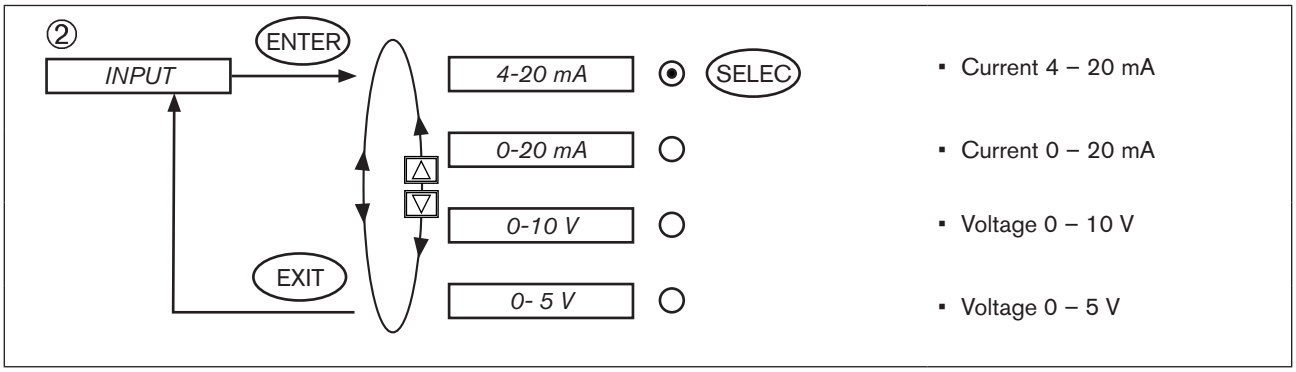

Fig. 3: Operating structure of INPUT

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2.4.4 Automatic adjustment (autotune) of the position controller

③ ***X.TUNE*** - Autotune for position controller

WARNING!

While the *X.TUNE* function is running, the valve automatically moves from its current position!

- Never run *X.TUNE* while a process is running!
- Take appropriate measures to prevent the equipment from being accidentally actuated!

CAUTION!

Avoid maladjustment of the controller due to an incorrect supply pressure or applied operating medium pressure!

- Run *X.TUNE* **whenever** the supply pressure (= pneumatic auxiliary energy) is available during subsequent operation.
- Run the *X.TUNE* function preferably **without** operating medium pressure to exclude interference caused by flow forces.

The following functions are actuated automatically:

- Adjustment of the sensor signal to the (physical) stroke of the actuator used
- Determination of parameters for the PWM signals to control the solenoid valves integrated in the positioner
- Adjustment of the controller parameters for the position controller. Optimisation occurs according to the criteria of a shortest possible correction time with a simultaneous freedom from overshoot.

→ You start Autotune by selecting *X.TUNE* in the main menu (MAIN) using the arrow keys.

→ Then hold down the right selection key (RUN) for approx. 3 seconds (countdown on display).

When the automatic adjustment completes, the message "*X.TUNE READY*" * is indicated.

→ Press any key to return to the main menu.

To stop *X.TUNE*, press the left or right selection key (STOP).

Sequence for automatic adjustment of the position controller to the particular operating conditions

Display	Description
X.TUNE started	Start of *X.TUNE*
TUNE #0 Init *TUNE #1 Max-Pos* *TUNE #2 Min-Pos* :	Display of the *X.TUNE* phase which is currently running (progress is indicated by a progress bar along the upper edge of the display).
X.TUN Eready	Display at the end of *X.TUNE*
or	
TUNE err/break	Display when a fault occurs

* *If a fault occurs: "TUNE err/break"*

2.4.5 Adding auxiliary functions

④ ***ADD.FUNCTION***

With *ADD.FUNCTION* auxiliary functions can be included in the main menu.
See chapter entitled "*Configuration of auxiliary functions*".

→ Skip this menu option during the initial start-up.

2.4.6 Leaving the main menu

To leave the main menu, press the left selection key (EXIT).
In doing so, the changes are transferred to the memory (EEPROM). *"save EEPROM"* is indicated on the display.
The device is then returned to the operating state in which it was before you switched to the main menu (MANUAL or AUTOMATIC).

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3 OPERATION OF THE POSITION CONTROLLERS

A precise description of the control and display elements, as well as the configuration of the keys can be found in the chapter entitled *"Control and display elements"*.

When the operating voltage has been switched on, the positioner is at the process operating level in the AUTOMATIC operating state.

At the process operating level the normal control mode is implemented and monitored (AUTOMATIC) and the valve is manually opened or closed (MANUAL).

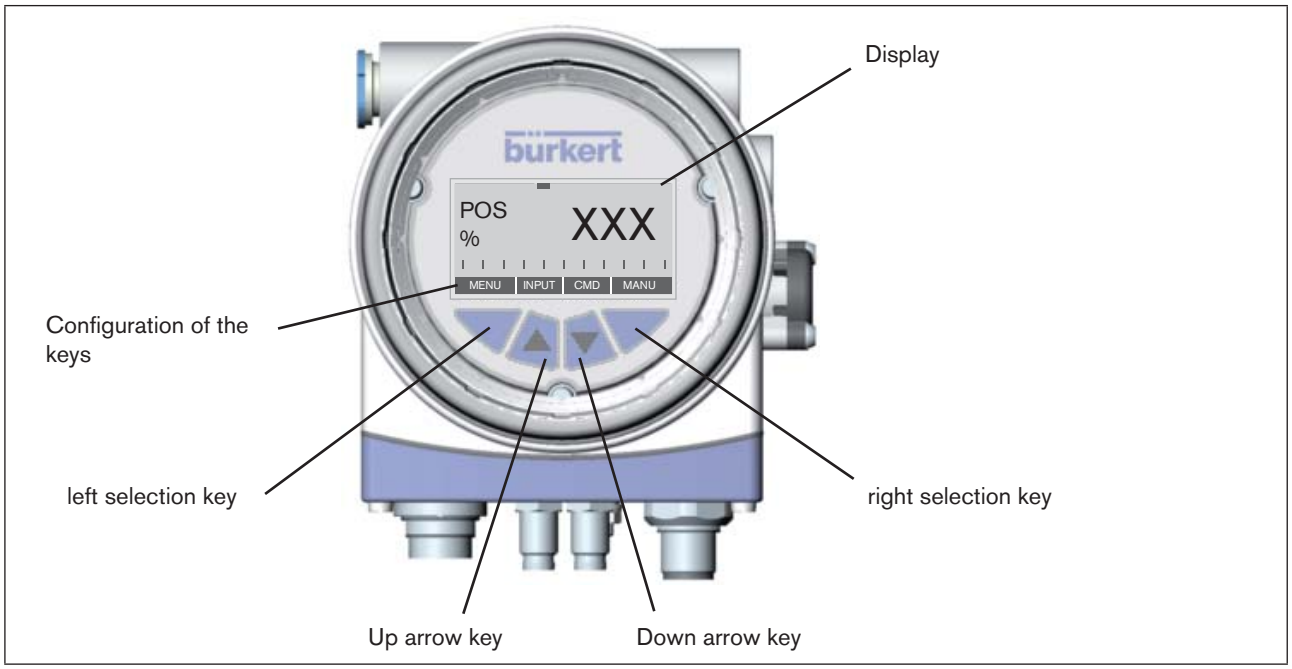

Fig. 4: Description of the control module

3.1 Switching between the Operating States

The right Selection key can be used to switch between the two operating states AUTOMATIC (AUTO) and MANUAL (MANU).

In the AUTOMATIC operating state a bar runs along the upper edge of the display from left to right.

3.2 Switching between the Operating Levels

Process operating level -> Configuration level

Both in the MANUAL and AUTOMATIC operating state you switch to the configuration level by pressing the left selection key (MENU) for approx. 3 seconds. During these 3 seconds 2 bars converge on the display (Countdown).

At the Configuration level the operating parameters can be input or changed, auxiliary functions supplemented or the automatic adjustment (*X.TUNE*) of the controller started.

A precise description of the individual functions can be found in the chapters entitled *"Specifying the basic settings"* and in *"Configuring the auxiliary functions"*.

Configuration level -> Process operating level

Press the left selection key (EXIT) to switch from the Configuration level to the Process operating level. In doing so, the operating state which was selected before the switchover (AUTOMATIC or MANUAL) is set.

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3.3 AUTOMATIC operating state

Bar running from left to right along the upper edge of the display.

Normal control mode is implemented and monitored in AUTOMATIC operating state.

3.3.1 Meaning of the keys

key	Configuration	Description
Left selection key	MENU	Switch to the Configuration level (press for approx. 3 s)
Right selection key	MANU	Switch between the AUTOMATIC (AUTO) or MANUAL (MANU) operating modes
Up arrow key	INPUT POS CMD TEMP	Switch between the individual displays
Down arrow key	CMD TEMP INPUT POS	

3.3.2 Information on the Display

The following variables are indicated on the display for the position controller and it is possible to switch between them with the arrow keys:

Representation of value	Value range / unit	Description
POS XXX	0...100 %	Display of actual position of the valve actuator
CMD XXX	0...100 %	Display of nominal position of the valve actuator
TEMP XXX	-100 – 150 °C	Internal temperature in the housing of the positioner
INPUT XXX	0/4 – 20 mA, 0 – 5/10 V	Input signal for nominal position

3.3.3 Operating Structure

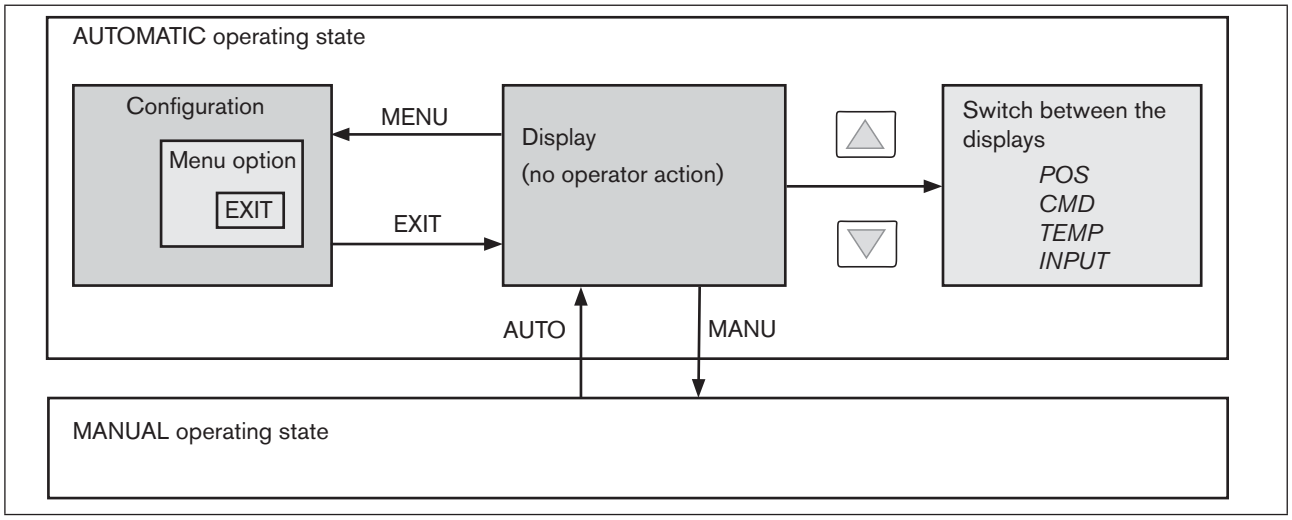

Fig. 5: AUTOMATIC operating structure

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3.4 MANUAL operating state

Without bar running from left to right along the upper edge of the display.
In MANUAL operating state the valve can be opened or closed manually.

3.4.1 Meaning of the keys

key	Configuration	Description
Left selection key	MENU	Switch to the Configuration level (press for approx. 3 s)
Right selection key	MANU	Switch between the AUTOMATIC (AUTO) or MANUAL (MANU) operating modes
Up arrow key	OPN CLS*	Aerate the actuator Control function A (SFA): Valve opens Control function B (SFB): Valve closes Control function I (SFI): Connection 2.1 aerated
Down arrow key	CLS OPN*	Deaerate the actuator Control function A (SFA): Valve closes Control function B (SFB): Valve opens Control function I (SFI): Connection 2.2 aerated

SFA: Actuator closes by spring force
SFB: Actuator opens by spring force
SFI: Actuator double-acting

3.4.2 Information on the Display

After switching to the MANUAL operating state, the display automatically jumps to the actual position (POS) of the valve actuator.

3.4.3 Operating structure

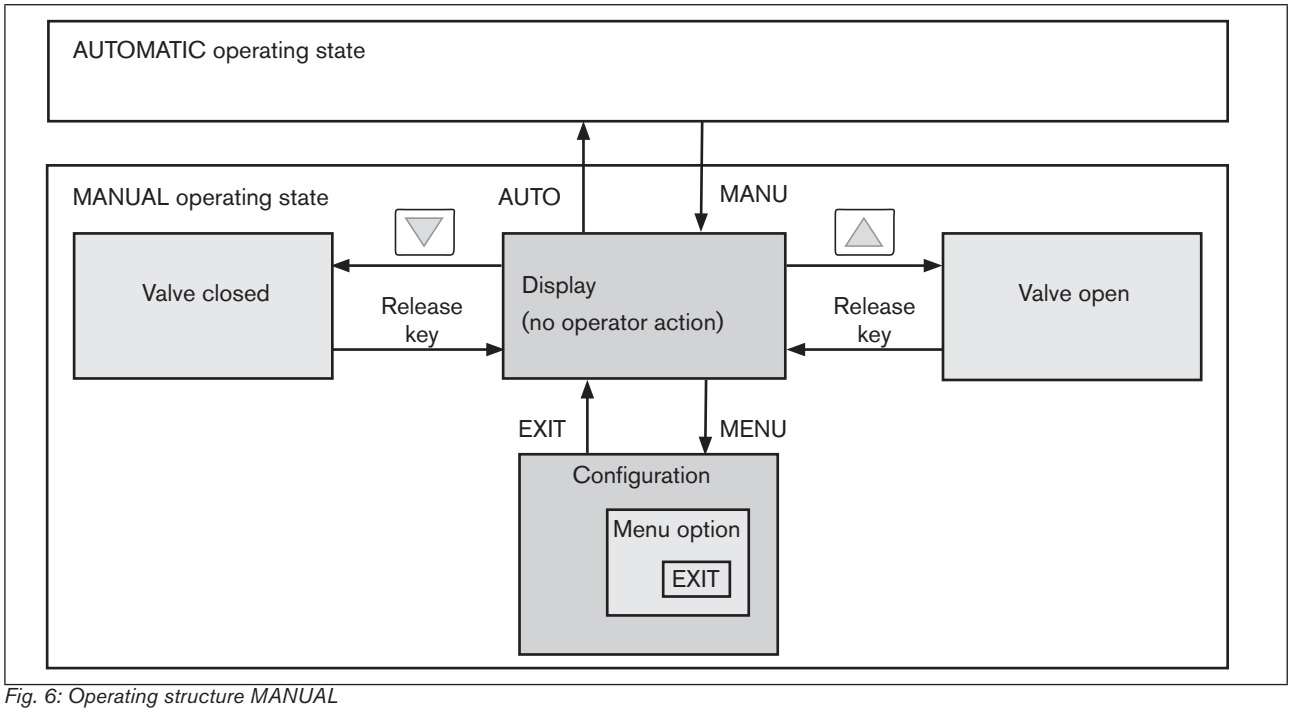

Fig. 6: Operating structure MANUAL

* *only if "Fall" is set in the DIR.ACT auxiliary function*

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4 CONFIGURING THE AUXILIARY FUNCTIONS

The operating concept for the positioner is based on a strict division between basic and auxiliary functions. When the device is delivered, only the basic functions are activated. They are used during the initial start-up to implement basic settings specific to the device. They are adequate for normal operation. For more demanding control tasks select and specifiy auxiliary functions at the Configuration level.

4.1 Keys at the Configuration level

Press the key	**in the menu**	**in a selected and confirmed menu option**
	Scroll up (select)	Increment (increase) numerical values
	Scroll down (select)	Decrement (reduce) numerical values
Press the key	**in the menu**	**in the *ADD.FUNCTION***
Selection keyon right ENTER	Retrieve the selected menu option to input parameters or start the *X.TUNE*	Select a menu option in the auxiliary menu for inclusion in or removal from the main menu. The menu option is indicated in the auxiliary menu by a cross (x) in the box
Press the key	**in the menu**	**in a selected and confirmed menu option**
Selection keyon right ENTER SELEC	Retrieve the selected menu option to input parameters or start the *X.TUNE*	Confirm the parameter selection marked with arrow keys.
Press the key	**in the menu**	**in a selected and confirmed menu option**
Selection keyon left EXIT	The Configuration level is left and the data is saved in the memory (EEPROM).	Leave a sub-menu option.

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4.2 Configuration menu

4.2.1 Switching between Process operating level and Configuration level

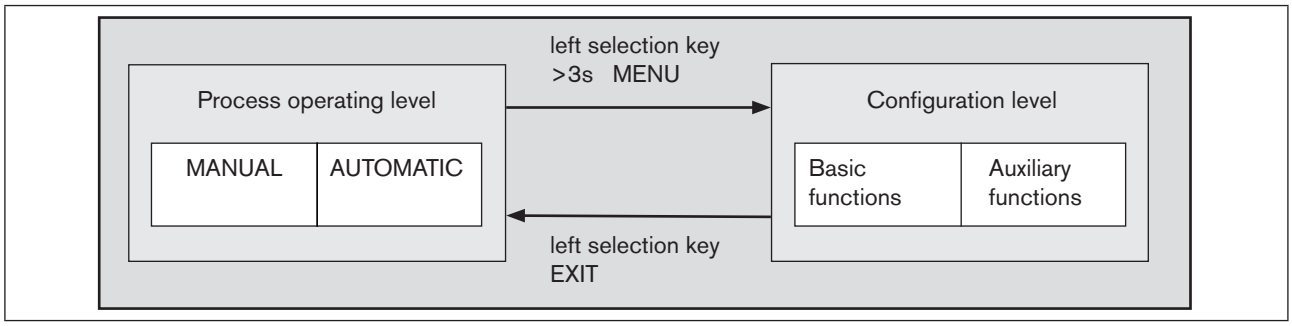

Fig. 7: Operating levels

→ To activate the Configuration menu, press the left selection key (MENU) at the Process operating level for approx. 3 seconds (wait for countdown).

The Configuration menu consists of the main menu and auxiliary menu. The main menu includes firstly the basic functions which you specify during the initial start-up. The auxiliary menu includes additional functions and is accessible via the *ADD.FUNCTION* menu option of the main menu. Device functions and parameters can be specified within the main menu. If required, extend the main menu with auxiliary menu functions which you can then specify.

4.2.2 Including auxiliary functions in the main menu

→ Press the arrow keys to select the *ADD.FUNCTION* menu option in the main menu and press the right selection key (ENTER) to enter the submenu.
→ Press the arrow keys to select the required auxiliary function.
→ Press the selection key on the right (ENTER) to mark the auxiliary function with a cross (x).
→ All marked functions are transferred to the main menu when the selection key on the left (EXIT) is pressed.
→ In the main menu input the parameters of the auxiliary functions.

4.2.3 Removing auxiliary functions from the main menu

If a function is removed from the main menu, the settings implemented previously under this function become invalid again.

→ Press the arrow keys to select the *ADD.FUNCTION* menu option in the main menu.
→ Enter the submenu by pressing the selection key on the right (ENTER).
→ Using the arrow keys, select an auxiliary function indicated with a cross (x).
→ Press the selection key on the right (ENTER) to remove the cross (x).
→ After pressing the selection key on the left (EXIT), the auxiliary function is deactivated and removed from the main menu.

4.2.4 Setting numerical values

You set numerical values in the designated menu options by pressing the up arrow key (increase numerical value) or down arrow key (reduce numerical value) once or several times.

In the case of four-digit numbers only the saved digit can be set with the up arrow key. Press the down arrow key to switch to the next digit (see Fig. 8).

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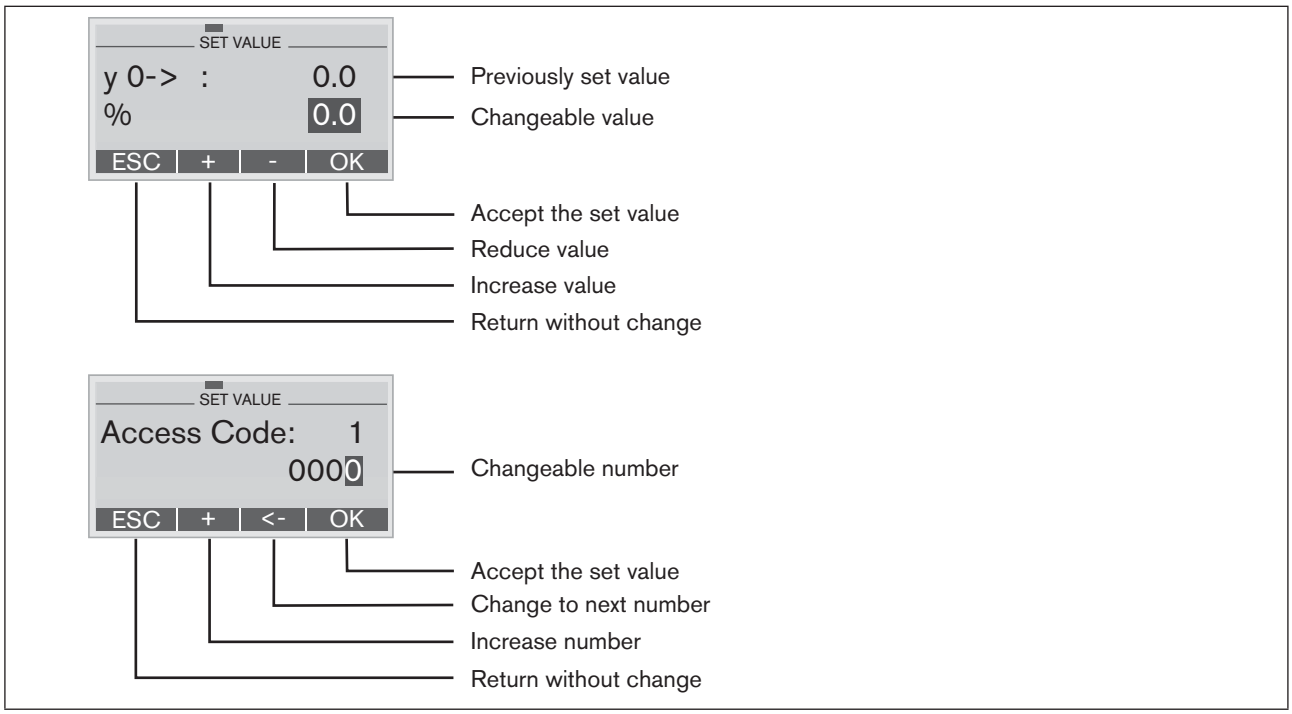

Fig. 8: Setting numerical values

4.2.5 Principle of including auxiliary functions in the main menu

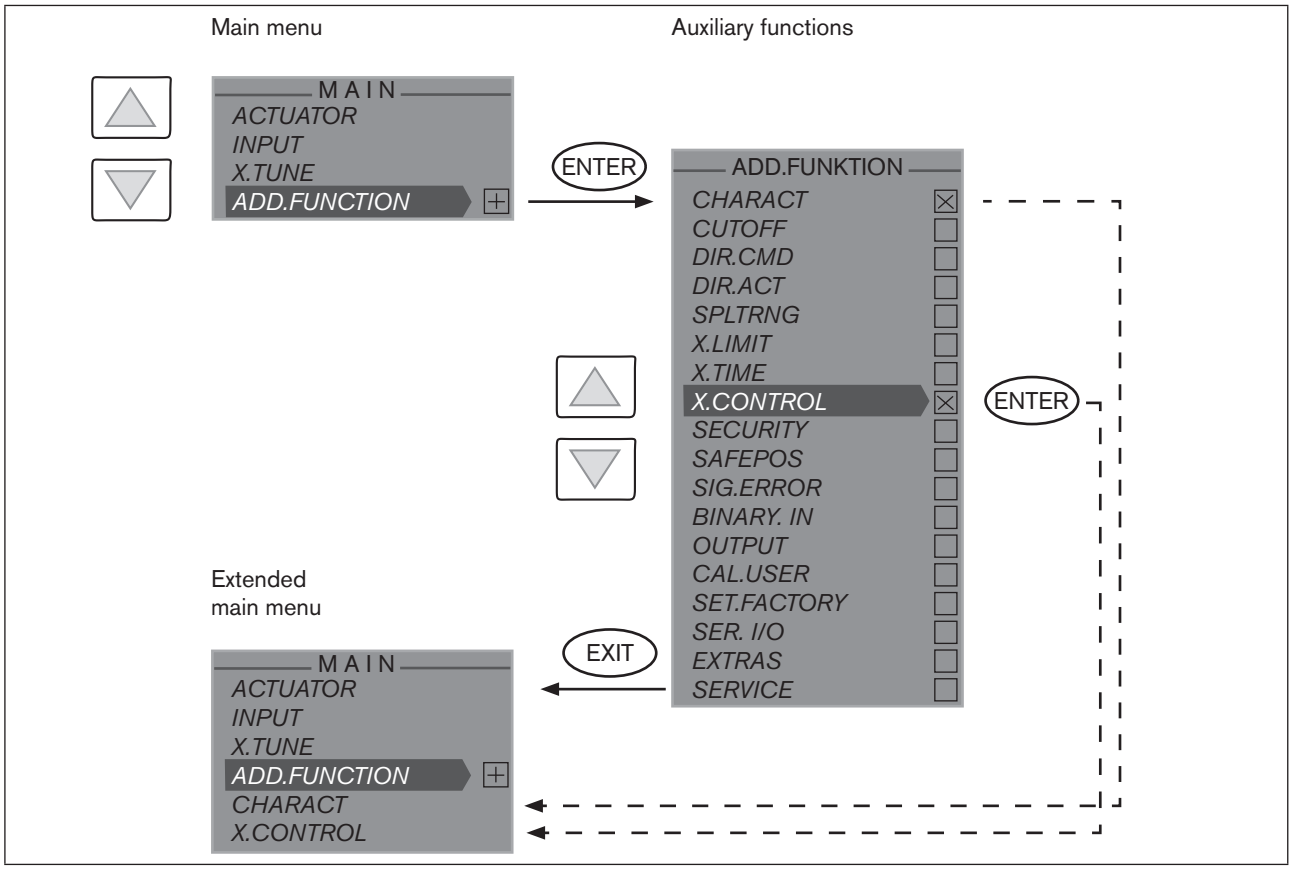

Fig. 9: Including auxiliary functions

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4.3 Auxiliary functions

Overview of auxiliary functions for the position controller Type 8692

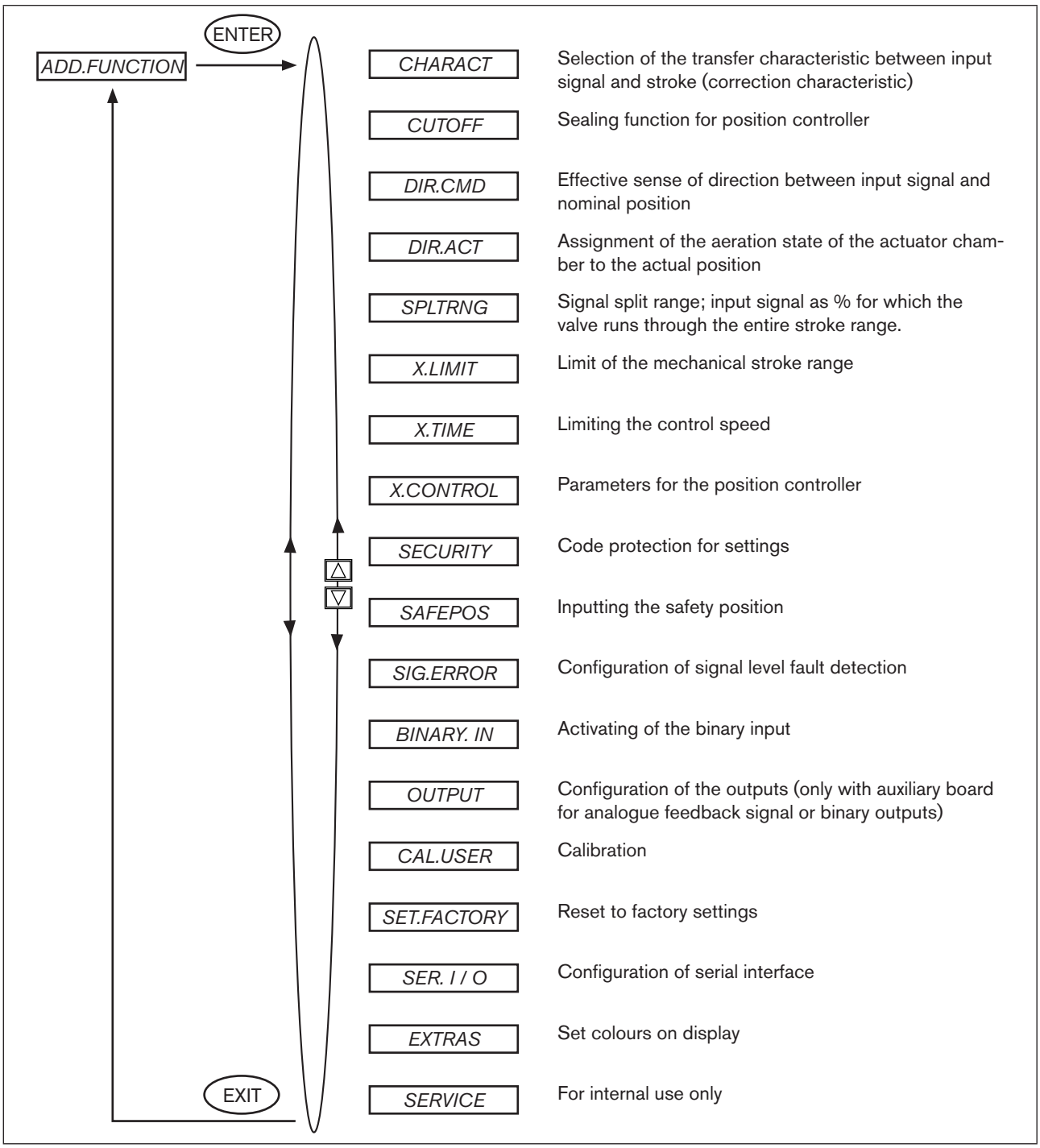

Fig. 10: Overview - auxiliary functions

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4.3.1 *CHARACT*

Select the transfer characteristic between input signal (position set-point value) and stroke

Characteristic (customer-specific characteristic)

Use this auxiliary function to select a transfer characteristic with reference to set-point value (nominal position, *CMD*) and valve stroke (*POS*) for correction of the flow or operating characteristic.

Factory setting: *linear*

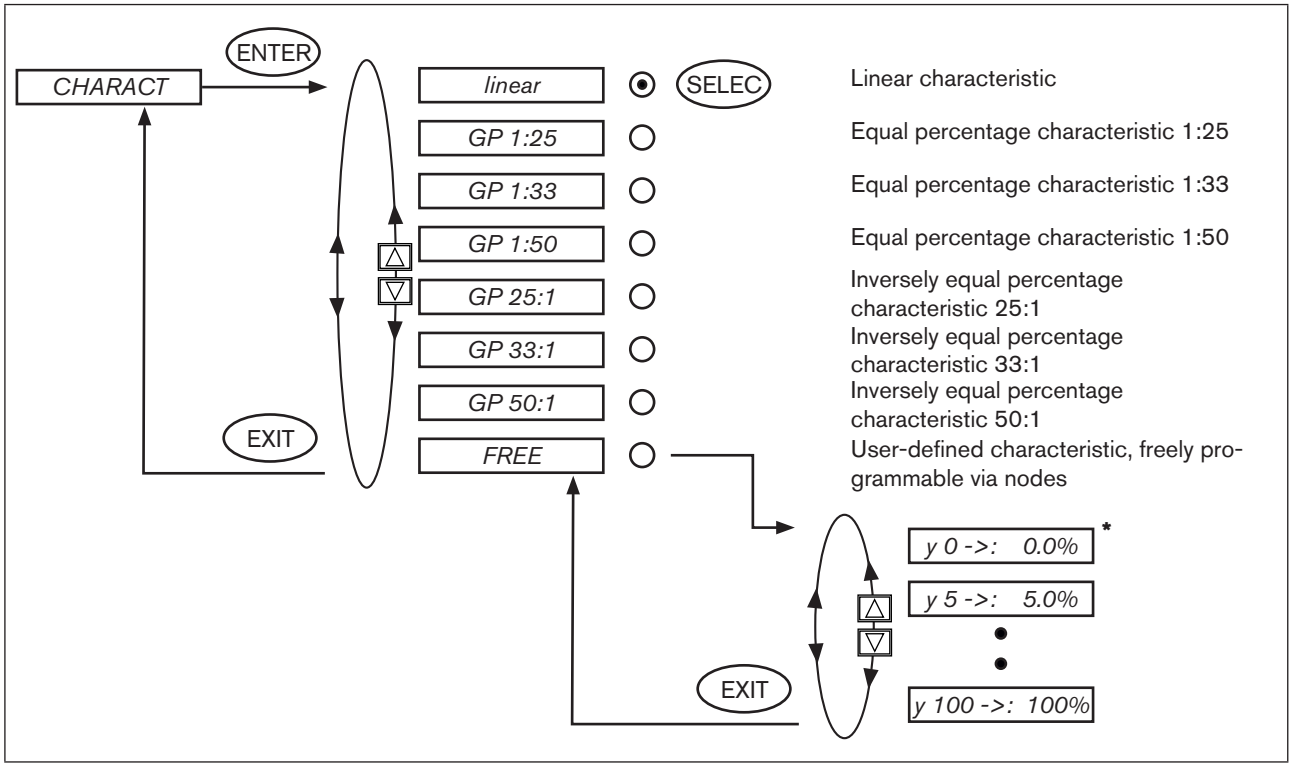

Fig. 11: Operating structure CHARACT

The flow characteristic $k_V = f(s)$ indicates the flow of a valve, expressed by the k_V value depending on the stroke s of the actuator spindle. It is specified by the design of the valve seat and the seat seal. In general two types of flow characteristics are implemented, the linear and the equal percentage.

In the case of linear characteristics identical k_V value changes k_V are assigned to identical stroke changes ds.

$$(dk_V = n_{lin} \cdot ds).$$

In the case of an equal percentage characteristic an equal percentage change of the k_V value corresponds to a stroke change ds.

$$(dk_V/k_V = n_{equalper} \cdot ds).$$

The operating characteristic Q = f(s) specifies the correlation between the volumetric flow Q in the installed valve and the stroke s. This characteristic has the properties of the pipelines, pumps and consumers. It therefore exhibits a form which differs from the flow characteristic.

** Input the nodes see "Inputting the freely programmable characteristic"*

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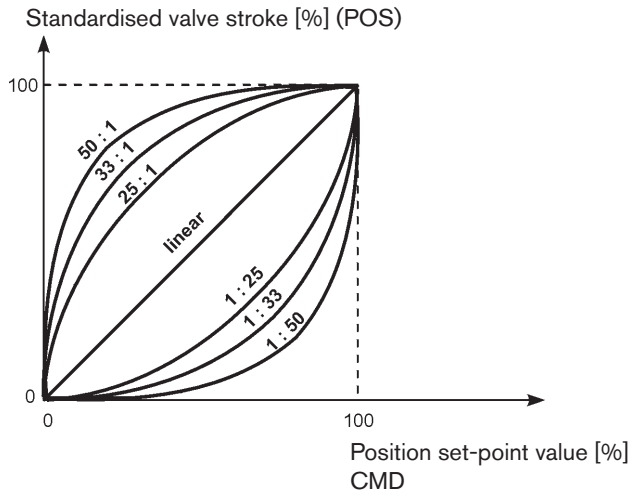

In the case of control tasks for closed-loop control systems it is usually particular demands which are placed on the course of the operating characteristic, e.g. linearity. For this reason it is occasionally necessary to correct the course of the operating characteristic in a suitable way. For this purpose the positioner features a transfer element which implements different characteristics. These are used to correct the operating characteristic.

Equal percentage characteristics 1:25, 1:33, 1:50, 25:1, 33:1 and 50:1 and a linear characteristic can be set. Furthermore, a characteristic can be freely programmed via nodes or automatically calibrated.

Inputting the freely programmable characteristic

The characteristic is defined via 21 nodes which are distributed uniformly via the position set-point values ranging from 0 – 100 %. Their distance is 5 %. A freely selectable stroke (adjustment range 0 – 100 %) is assigned to each node. The difference between the stroke values of two adjacent nodes must not be larger than 20 %.

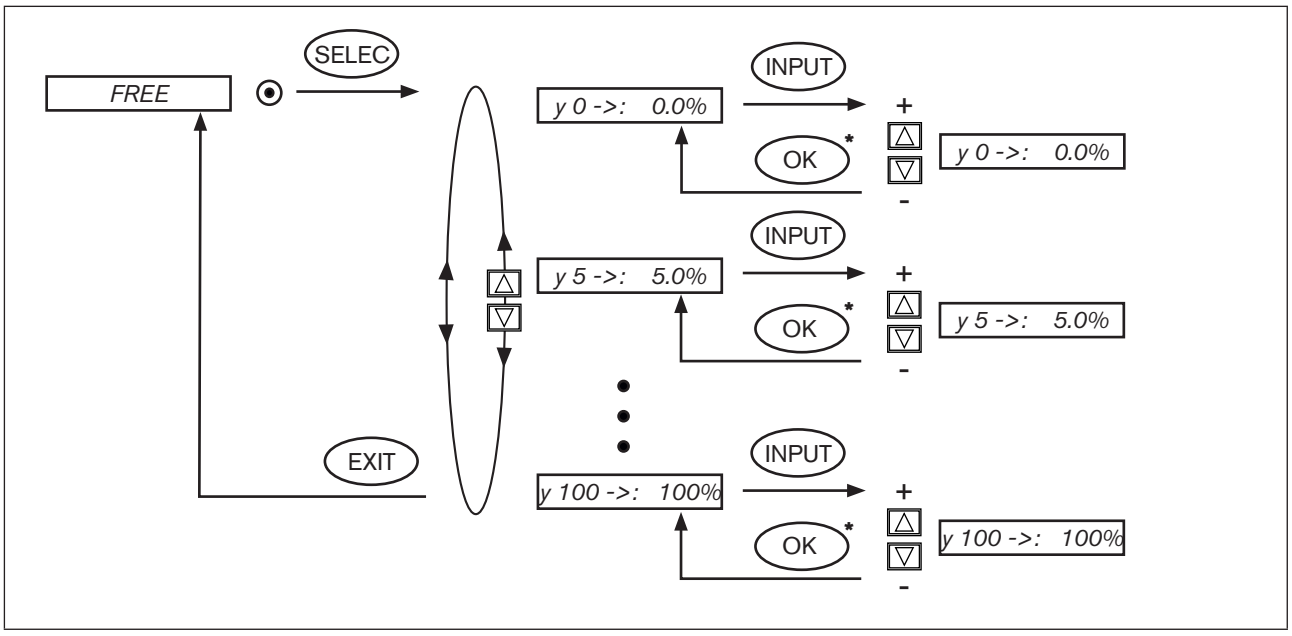

Fig. 12: Operating structure CHARACT FREE

** If the sub-menu is left by pressing the selection key on the left (ESC), the value remains unchanged.*

Procedure:

→ To input the characteristic points (function values), select the *FREE* sub-menu option using the arrow keys and confirm by pressing the selection key on the right (SELEC).

Another sub-menu (*FREE*) opens in which the individual nodes are listed (as %).

→ Select the individual nodes using the arrow keys and confirm by pressing the selection key on the right (INPUT) in order to change the value in the *SET VALUE* sub-menu.

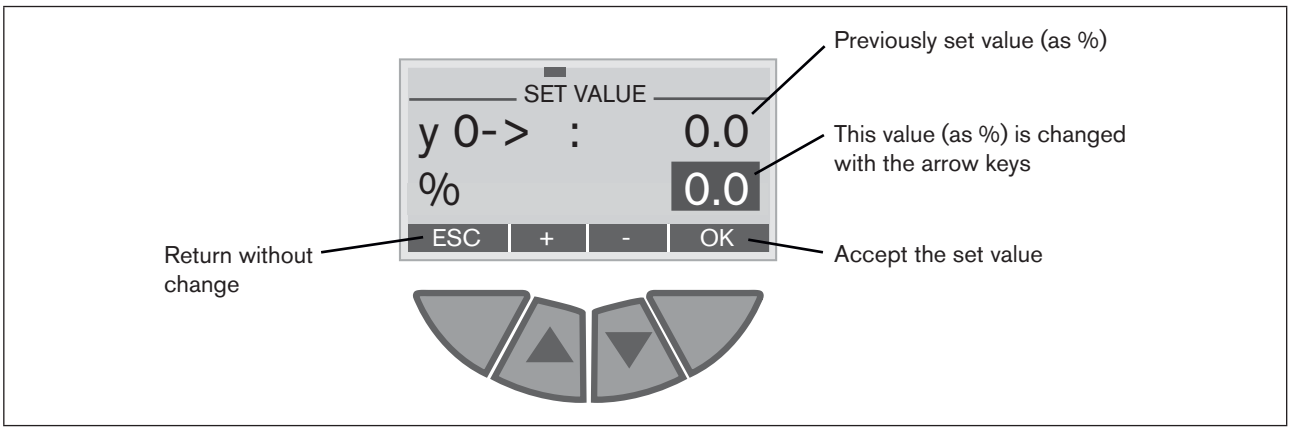

Fig. 13: Display CHARACT FREE

→ Using the arrow keys (+/-), set the function value from 0 to 100 % and confirm by pressing the selection key on the right (OK).

→ When all changes have been made, leave the sub-menu by pressing the selection key on the left (EXIT).

→ Press the selection key on the left again (EXIT) to return to the *CHARACT* menu option.

Changed values are not transferred into the memory (EEPROM) until the main menu (MAIN) is left.

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Example of a programmed characteristic

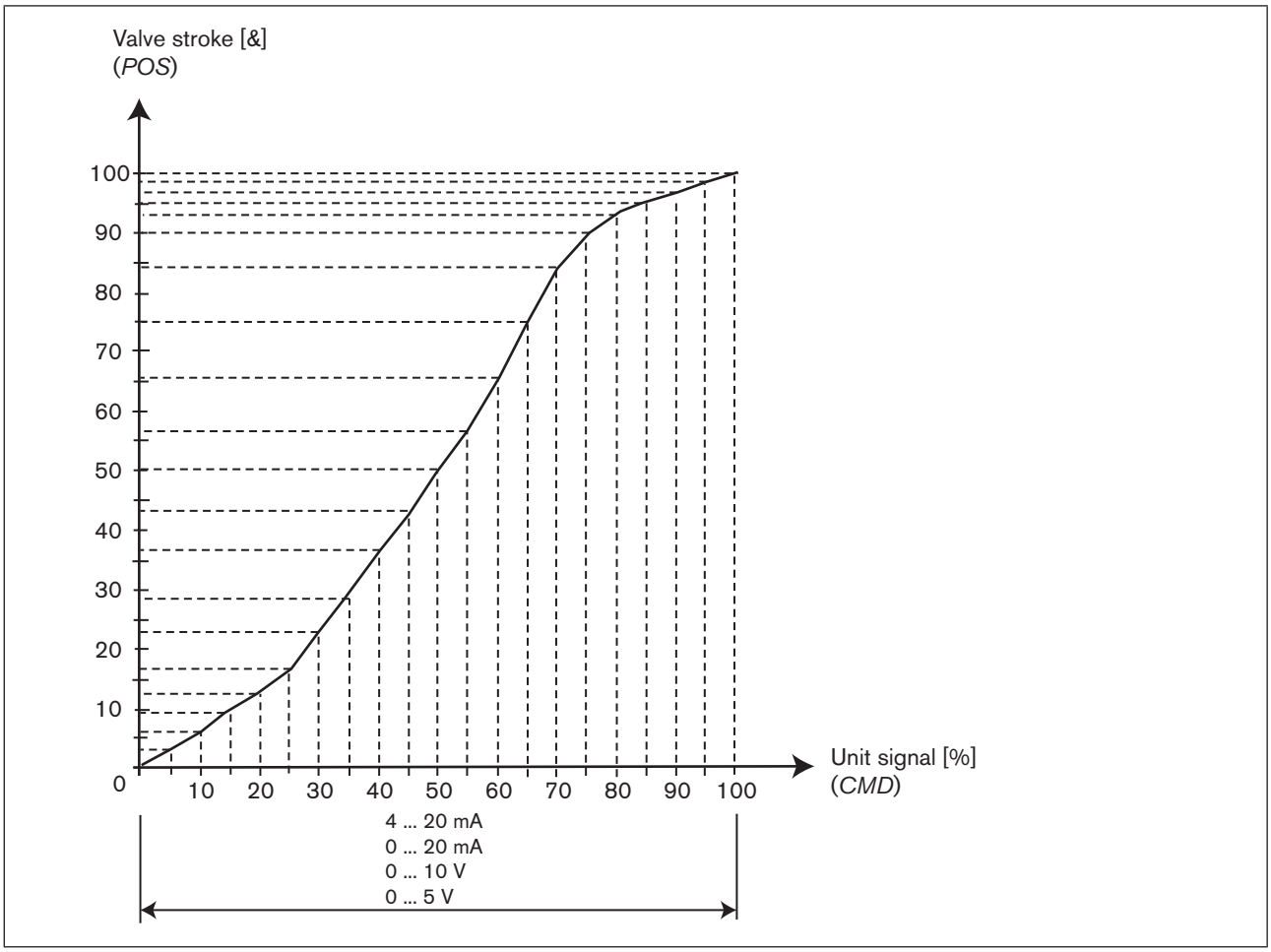

Fig. 14: Example of a programmed characteristic

In the Appendix *"Table of position controllers"* there is a table in which you can enter your settings for the freely programmable characteristic.

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4.3.2 *CUTOFF*
Sealing function for the position controller Type 8692

The sealing function for the process controller Type 8693 can be found in the chapter entitled *"Start-up, operation of the process controller Type 8693" - "Auxiliary functions for the process controller"*.

This function causes the valve to be sealed outside the control area.

This is where you input the limits for the position set-point value (*CMD*) as a percentage, from which the actuator is fully de-aerated or aerated.
Control mode opens or resumes at a hysteresis of 1 %.
If the process valve is in the sealing area, the message *"CUTOFF ACTIVE"* is indicated on the display.

Factory setting: *Min= 0 %*; *Max = 100 %*

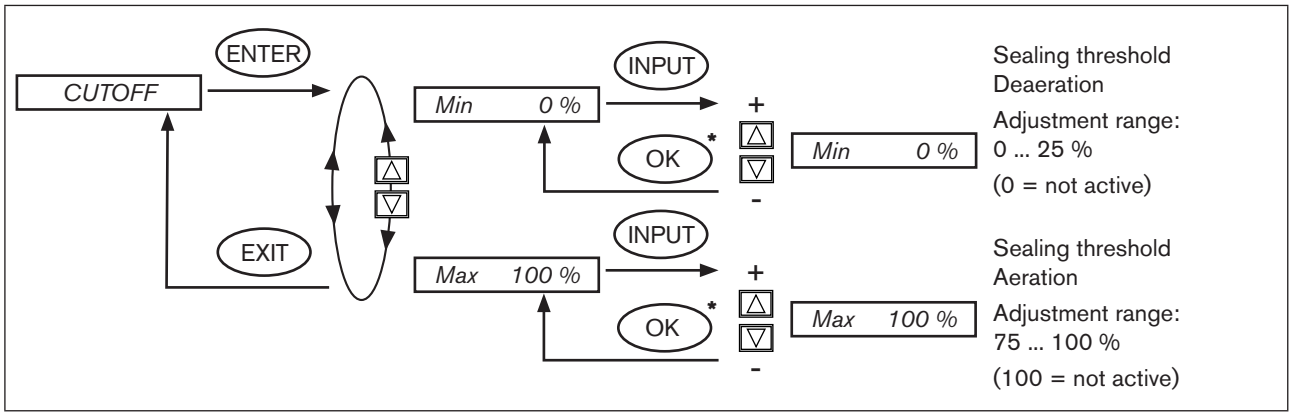

Fig. 15: Operating structure CUTOFF

Changed values are not transferred into the memory (EEPROM) until the main menu (MAIN) is left.

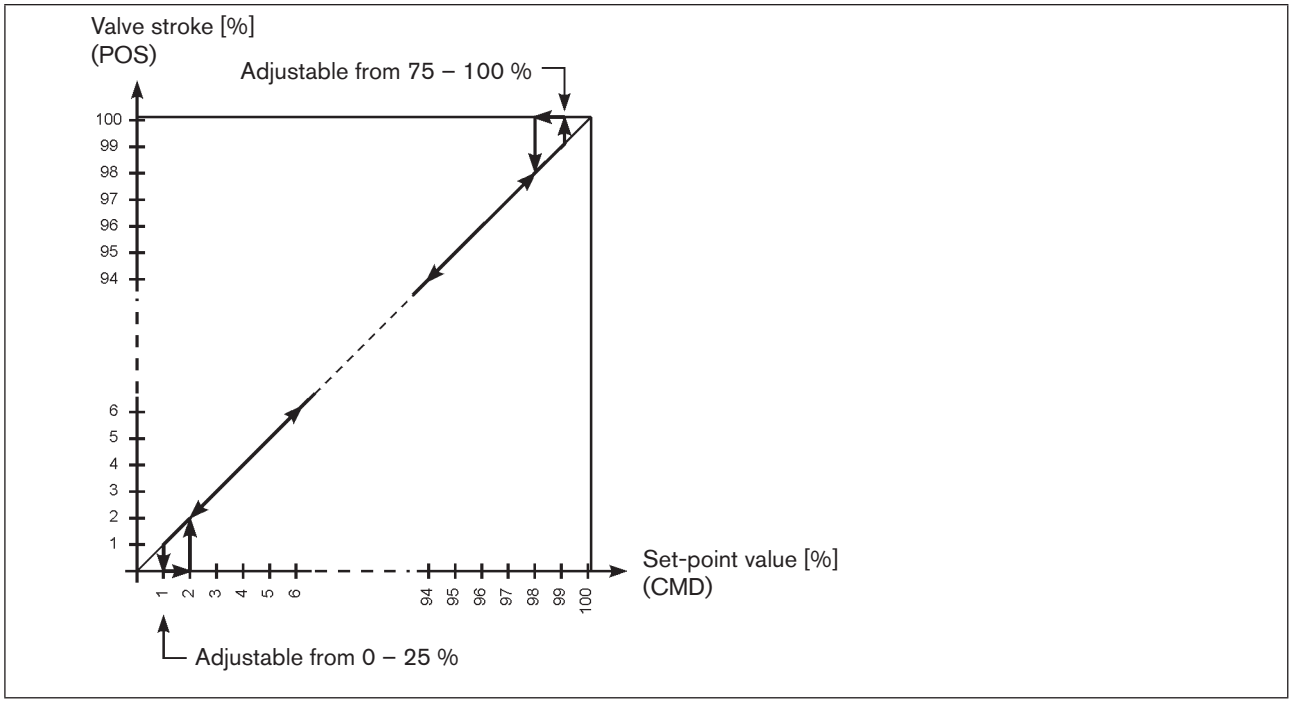

Fig. 16: Graph - CUTOFF

** If the sub-menu is left by pressing the selection key on the left (ESC), the value remains unchanged.*

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4.3.3 *DIR.CMD*
Effective sense of direction of the position controller set-point value

Use this auxiliary function to set the effective sense of direction between the input signal (*INPUT*) and the nominal position (*CMD*) of the actuator.

Factory setting: *Rise*

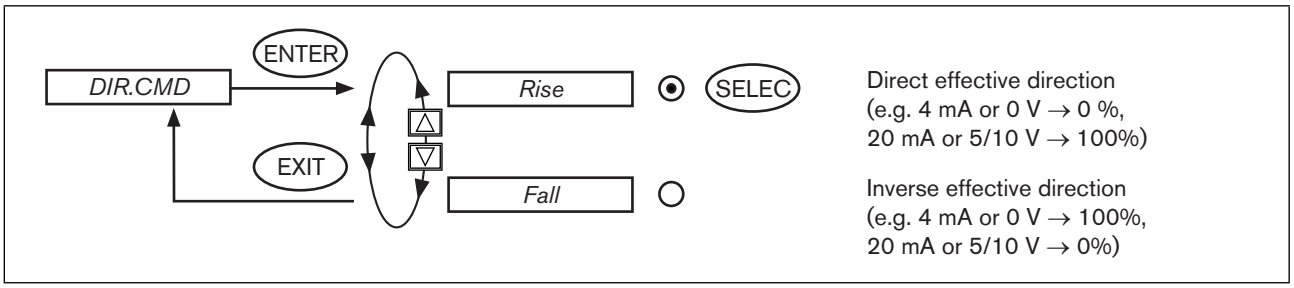

Fig. 17: Operating structure DIR.CMD

Changed values are not transferred into the memory (EEPROM) until the main menu (MAIN) is left.

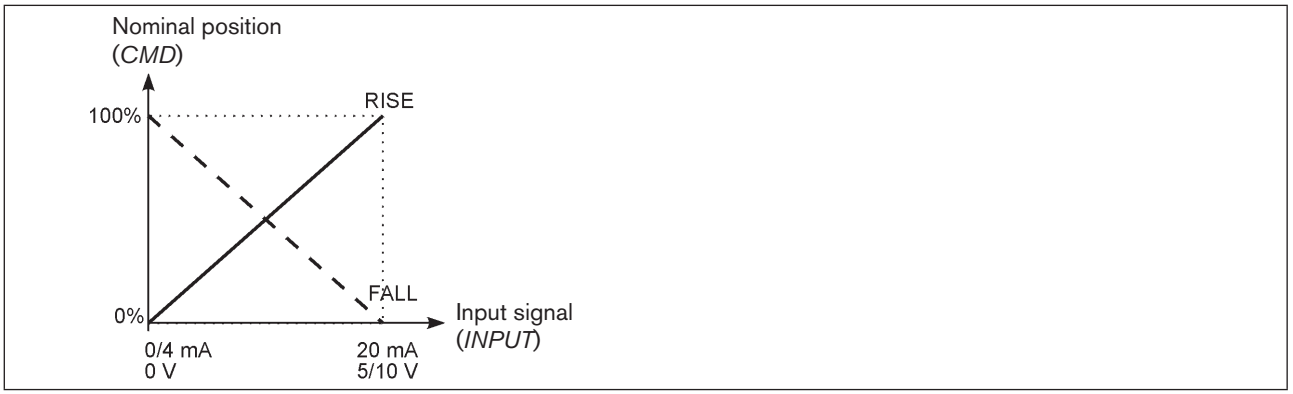

Fig. 18: Graph DIR.CMD

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4.3.4 *DIR.ACT*
Effective sense of direction of the actuator

Use this auxiliary function to set the effective sense of direction between the aeration state of the actuator and the actual position (*POS*).

Factory setting: *Rise*

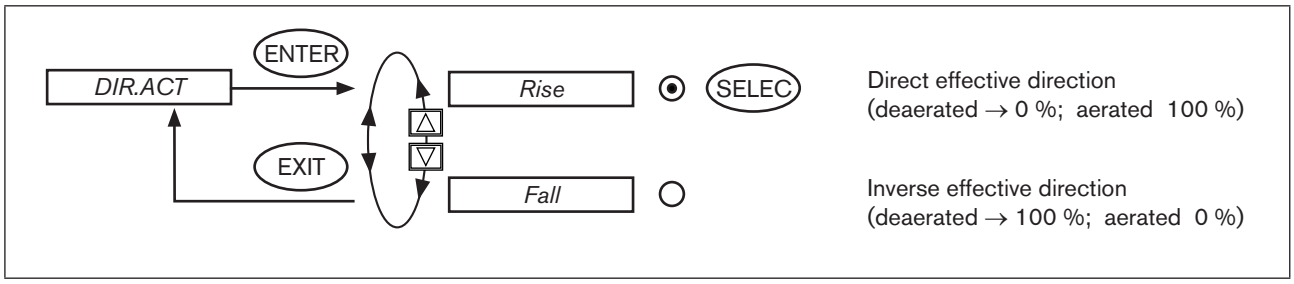

Fig. 19: Operating structure DIR.ACT

If the *Fall* function is selected, the description of the arrow keys (on the display) changes in the MANUAL operating state (OPN → CLS and CLS → OPN).
Changed values are not transferred into the memory (EEPROM) until the main menu (MAIN) is left.

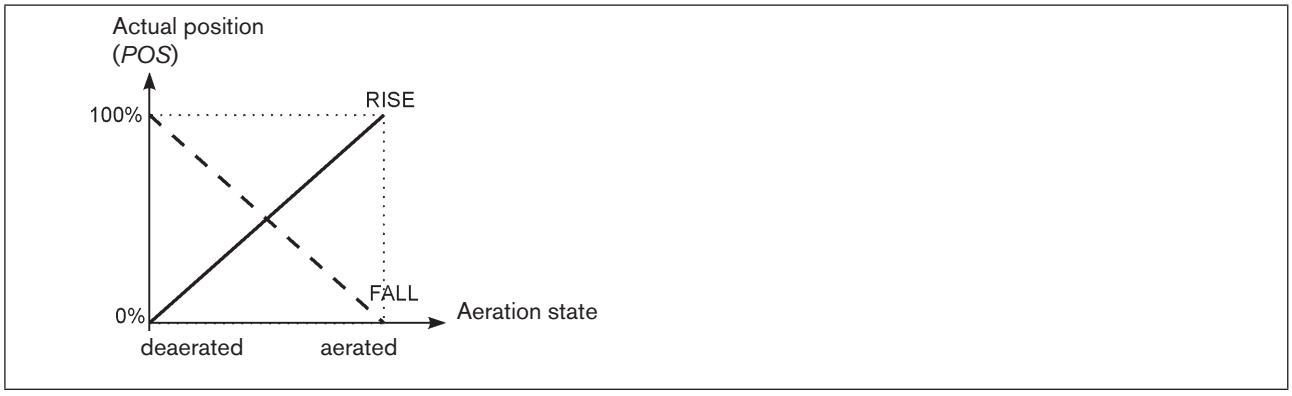

Fig. 20: Graph DIR.ACT

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4.3.5 *SPLTRNG*
Signal split range

Min. and max. values of the input signal as % for which the valve runs through the entire stroke range.

Factory setting: *Min = 0 %; Max = 100 %*

This function is effective only during operation as a position controller.

Use this auxiliary function to limit the position set-point value range of the positioner by specifying a minimum and a maximum value. As a result, it is possible to divide a utilised unit signal range (4 – 20 mA, 0 – 20 mA, 0 – 10 V or 0 – 5 V) into several positioners (without or with overlapping). This allows several valves to be used **alternately** or in the case of overlapping set-point value ranges **simultaneously** as actuators.

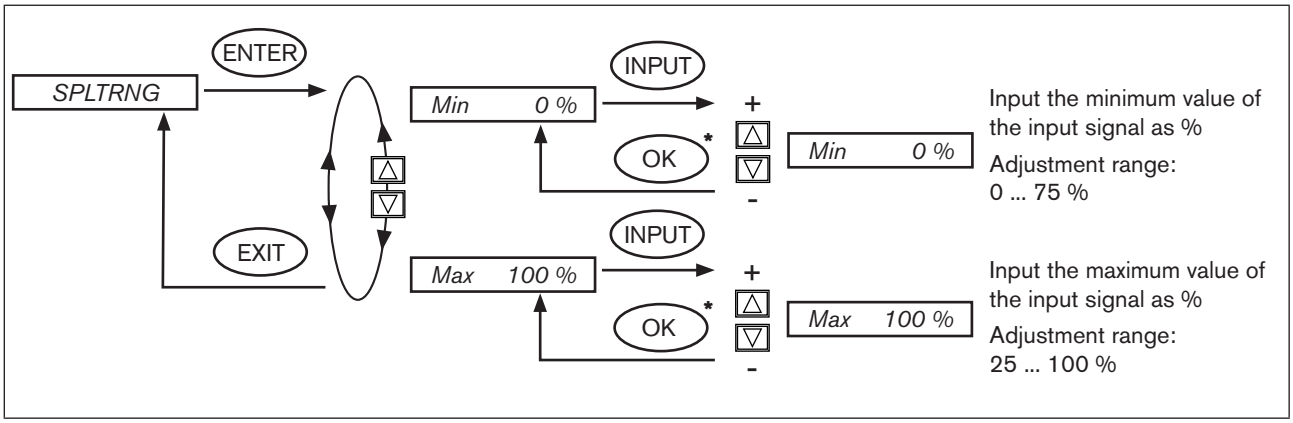

Fig. 21: Operating structure SPLTRNG

Changed values are not transferred into the memory (EEPROM) until the main menu (MAIN) is left.

Splitting a unit signal range into two set-point value ranges

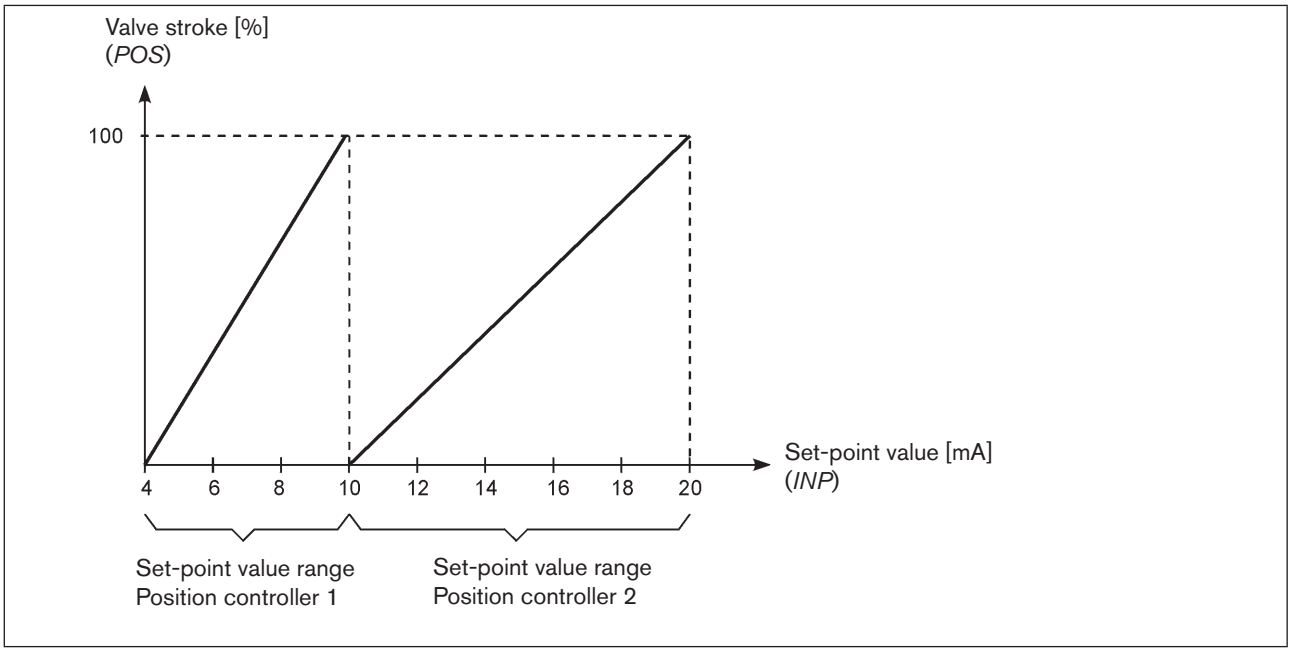

Fig. 22: Graph SPLTRNG

** If the sub-menu is left by pressing the selection key on the left (ESC), the value remains unchanged.*

4.3.6 *X.LIMIT*
Lmits the mechanical stroke range

This auxiliary function limits the (physicali) stroke to specified % values (minimum and maximum). In doing so, the stroke range of the limited stroke is set equal to 100 %. If the limited stroke range is left during operation, negative *POS* values or *POS* values are indicated greater than 100 %.

Factory setting: *Min = 0%, Max = 100%*

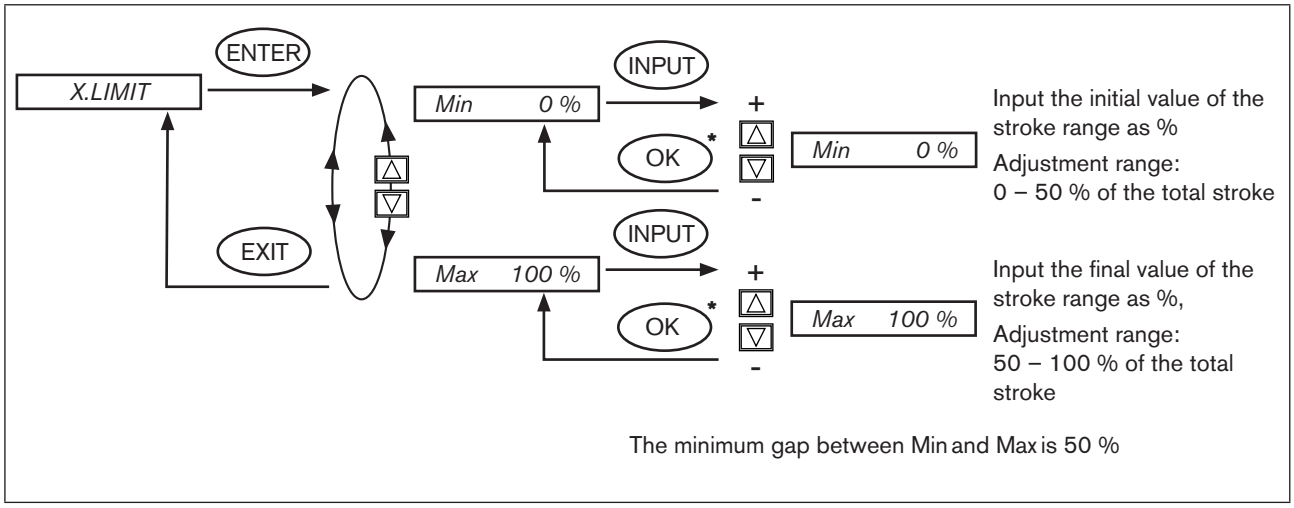

Fig. 23: Operating structure X.LIMIT

Changed values are not transferred into the memory (EEPROM) until the main menu (MAIN) is left.

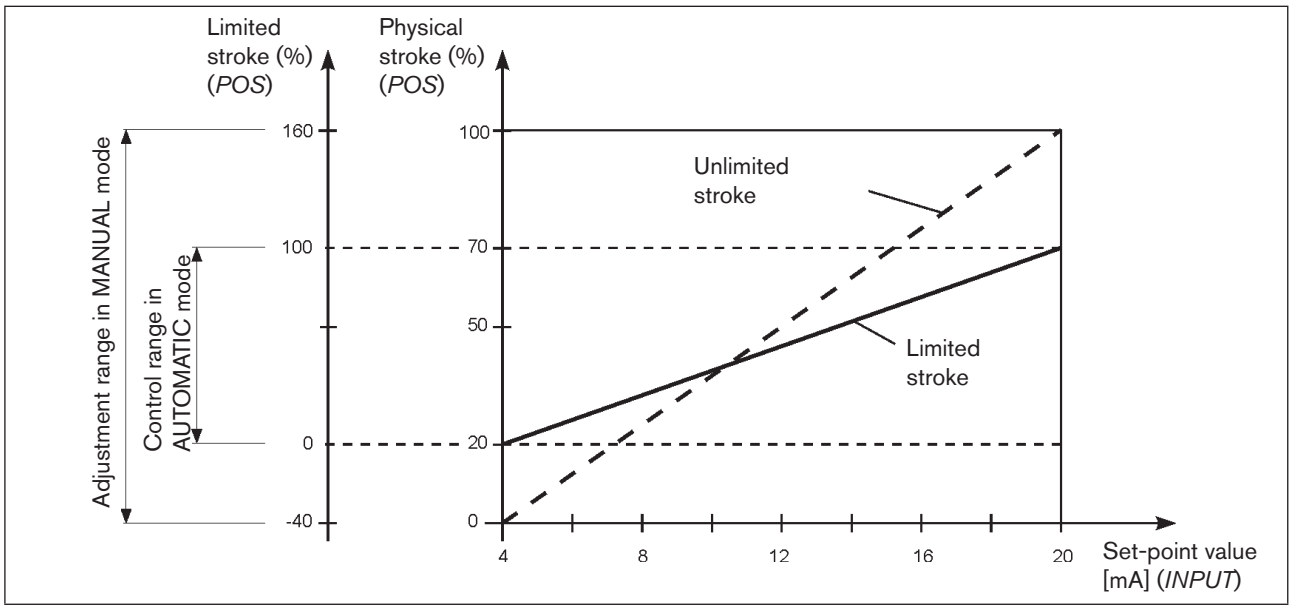

Fig. 24: Graph X.LIMIT

** If the sub-menu is left by pressing the selection key on the left (ESC), the value remains unchanged.*

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4.3.7 *X.TIME*
Limiting the control speed

Use this auxiliary function to specify the opening and closing times for the entire stroke and limit the control speeds.

When the *X.TUNE* function is running, the minimum opening and closing time for the entire stroke is automatically entered for *Open* and *Close*. Therefore, movement can be at maximum speed.

Factory setting: values determined at the factory by the *X.TUNE*

If the control speed is limited, values can be input for *Open* and *Close* which are between the minimum values determined by the *X.TUNE* and 60 s.

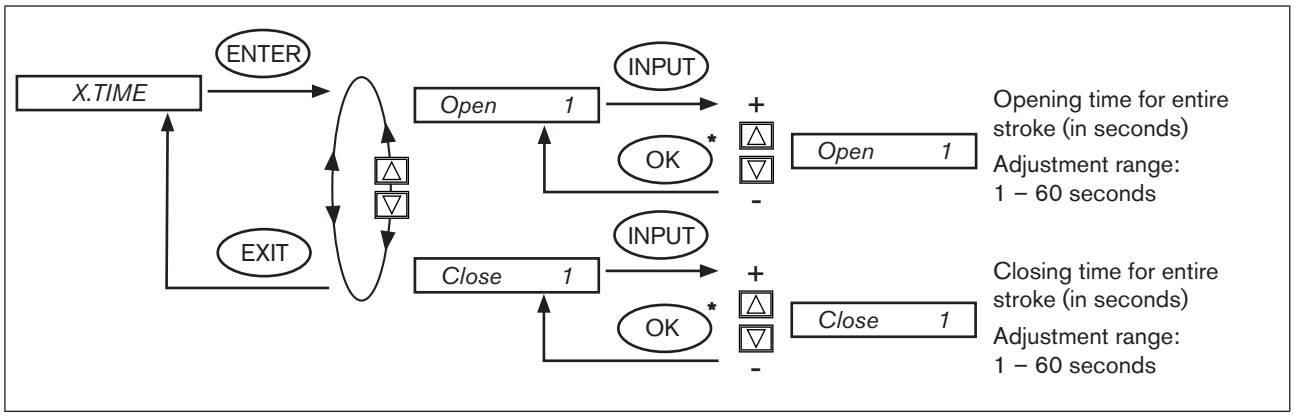

Fig. 25: Operating structure X.TIME

Changed values are not transferred into the memory (EEPROM) until the main menu (MAIN) is left.

Effect of limiting the opening speed when there is a jump in the set-point value

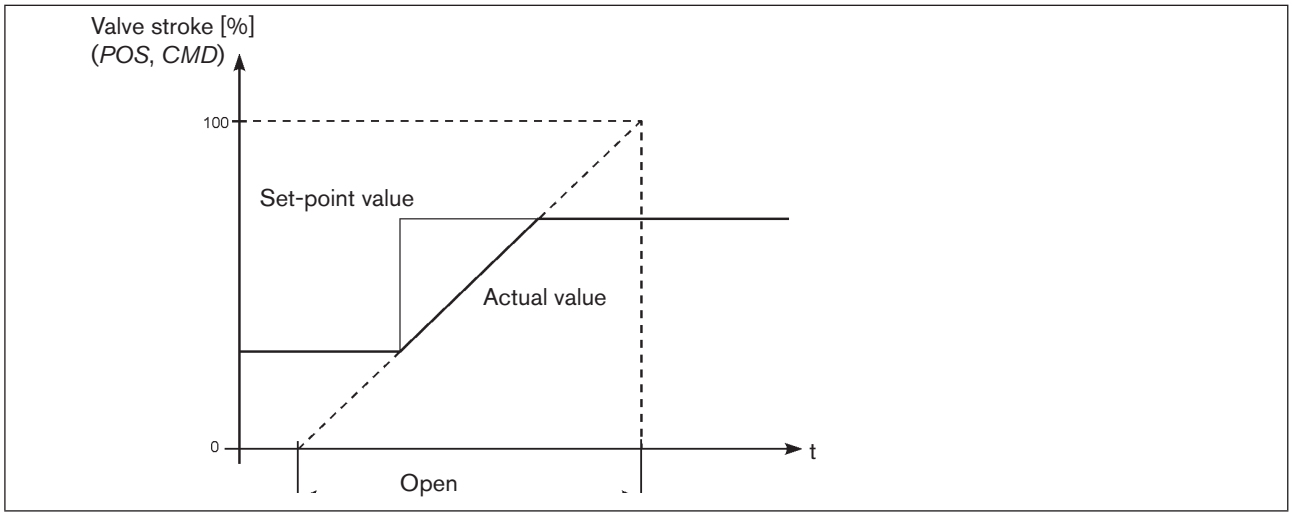

Fig. 26: Graph X.TIME

** If the sub-menu is left by pressing the selection key on the left (ESC), the value remains unchanged.*

4.3.8 *X.CONTROL*
Parameterisation of the position controller

Use this function to set the parameters for the position controller (dead band and amplification factors).

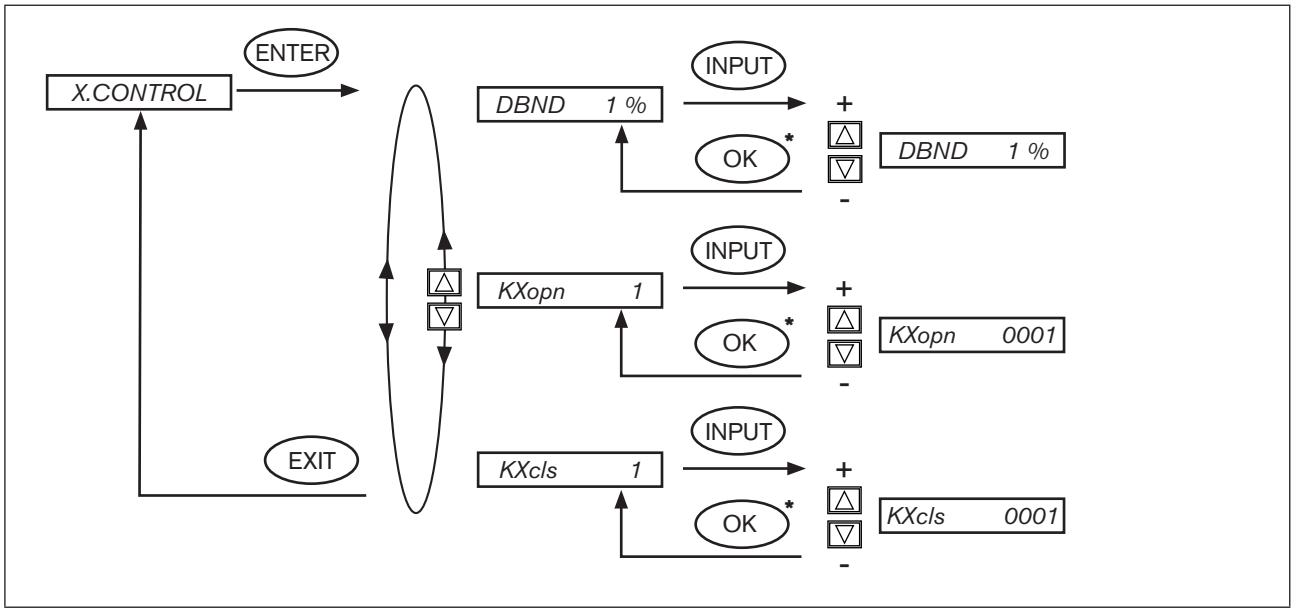

Fig. 27: Operating structure X.CONTROL

DBND **Insensitivity range (dead band) of the position controller**

Input the dead band as %, relating to the scaled stroke range;

i.e. *X.LIMIT Max - X.LIMIT Min* (see Auxiliary function *X.LIMIT*).

This function causes the controller to respond from a specific control difference only. This function protects the solenoid valves in the positioner and the pneumatic actuator.

If the auxiliary function *X.CONTROL* is in the main menu while *X.TUNE* (Autotune of the position controller) is running, the dead band *DBND* is determined automatically depending on the friction behaviour of the actuator. The value determined in this way is an approximate value. You can re-adjust it manually.

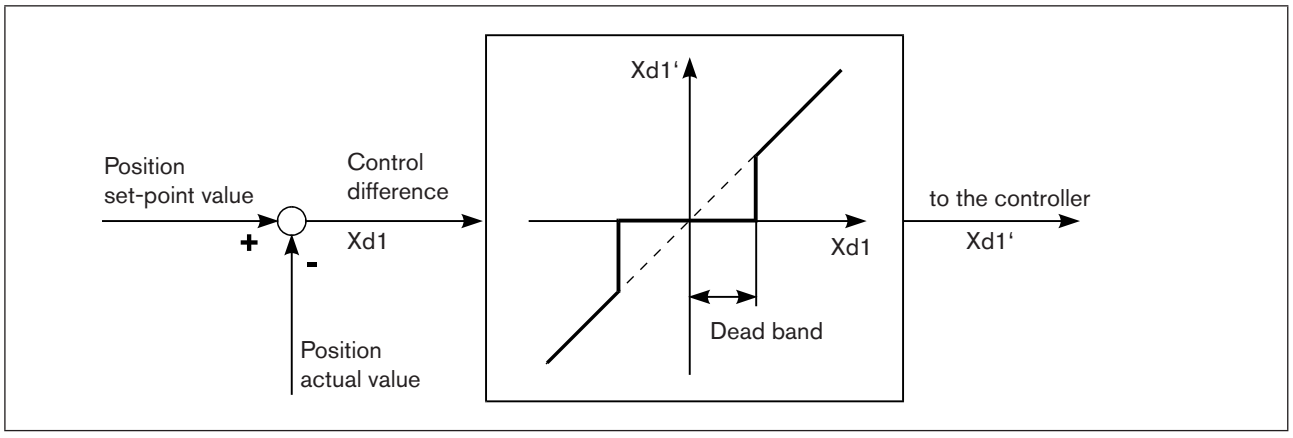

Fig. 28: Graph X.CONTROL

KX XXX **Parameters for the position controller**

KXopn Amplification factor of the position controller (for closing the valve)

KXcls Amplification factor of the position controller (for opening the valve)

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4.3.9 *SECURITY*
Code protection for the settings

Use the *SECURITY* function to prevent the positioner or individual functions from being accessed unintentionally.

Factory setting: *Access Code:* *0000*

If the code protection is activated, the code (set access code or master code) must be input whenever operator action is disabled.

All operator actions can be implemented with the non-changeable master code. This 4-digit master code can be found in the appendix of these operating instructions in the chapter entitled "*Master code*".

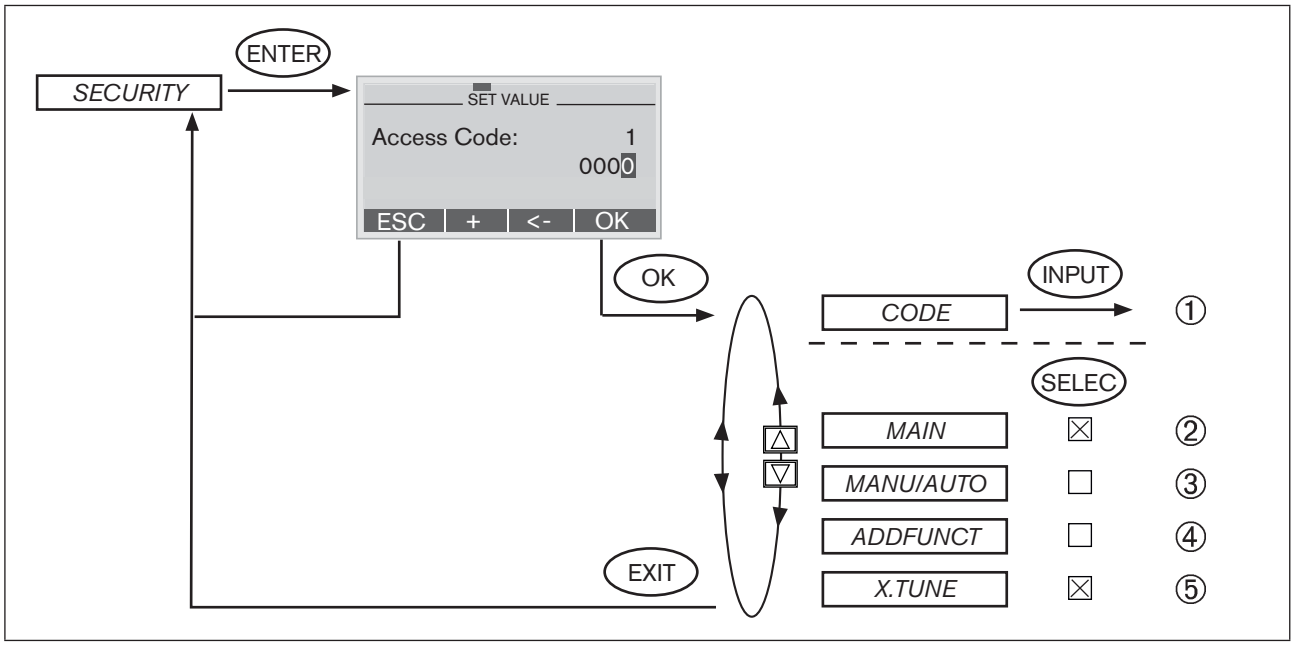


Fig. 29: Operating structure SECURITY

① Input screen for inputting or changing the *access code* (for description of input see below)

② Blocking access to the configuration level

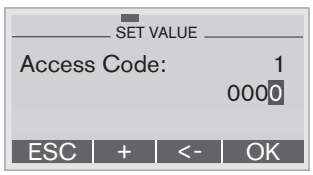
③ Blocking switchover between the MANUAL / AUTOMATIC (MANU/AUTO) operating states

④ Blocking the input of auxiliary functions

⑤ Blocking the activation of self-parameterisation (Autotune)

Inputting the *access code*:

→ Press the selection key on the right (INPUT) to access the input screen when the *CODE* selection menu is marked.



The code consists of four digits which can be changed individually by pressing the up arrow key (+).

Press the down arrow key (←) to jump between the individual digits.

Press the selection key on the left (ESC) to leave the input screen without change.

Press the selection key on the right (OK) to leave the input screen and save the input or change.

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4.3.10 *SAFEPOS*
Input the safety position

This function specifies the actuator safety position which is started at defined signals.

The set safety position is not started unless there is a corresponding signal at the binary input (for configuration see *BINARY-IN*) or if a signal error occurs (for configuration see *SIG-ERROR*).

In the case of the bus version (Profibus / DeviceNet) the safety position is also started with

- corresponding parameter telegram
- *BUS ERROR* (adjustable)

If the mechanical stroke range is limited with the *X.LIMIT* function, only safety positions within these limits can be started.

This function is executed in AUTOMATIC mode only.

Factory setting: 0 %

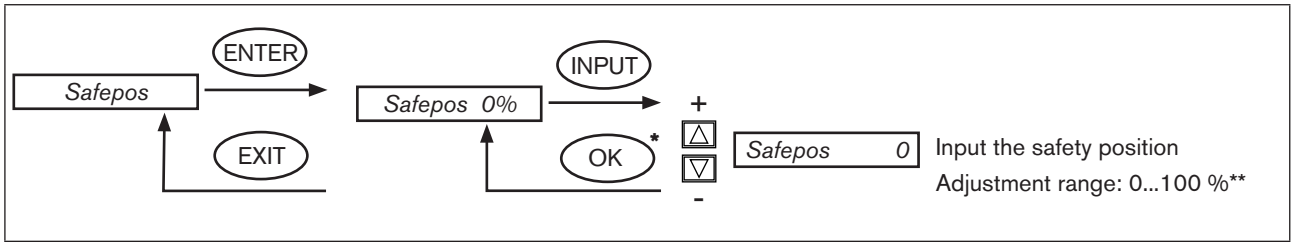

Fig. 30: Operating structure SAFEPOS

Changed values are not transferred into the memory (EEPROM) until the main menu (MAIN) is left.

* *If the sub-menu is left by pressing the selection key on the left (ESC), the value remains unchanged.*

** *If the safety position is 0 % or 100 %, the actuator is completely deaerated or aerated as soon as the safety position SIG-ERROR or BINARY-IN is active in the auxiliary functions.*

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4.3.11 *SIG-ERROR*
Configuration of signal level fault detection

The *SIG-ERROR* function is used to detect a fault on the input signal.

Fault detection
Fault detection can be selected at 4 – 20 mA signal only:
Fault with input signal ≤ 3.5 mA (± 0.5 % of final value, hysteresis 0.5 % of final value)

If other signal types are selected, the respective menu branch is hidden. If this configuration does not allow fault detection, *not available* is indicated in the selection menu.

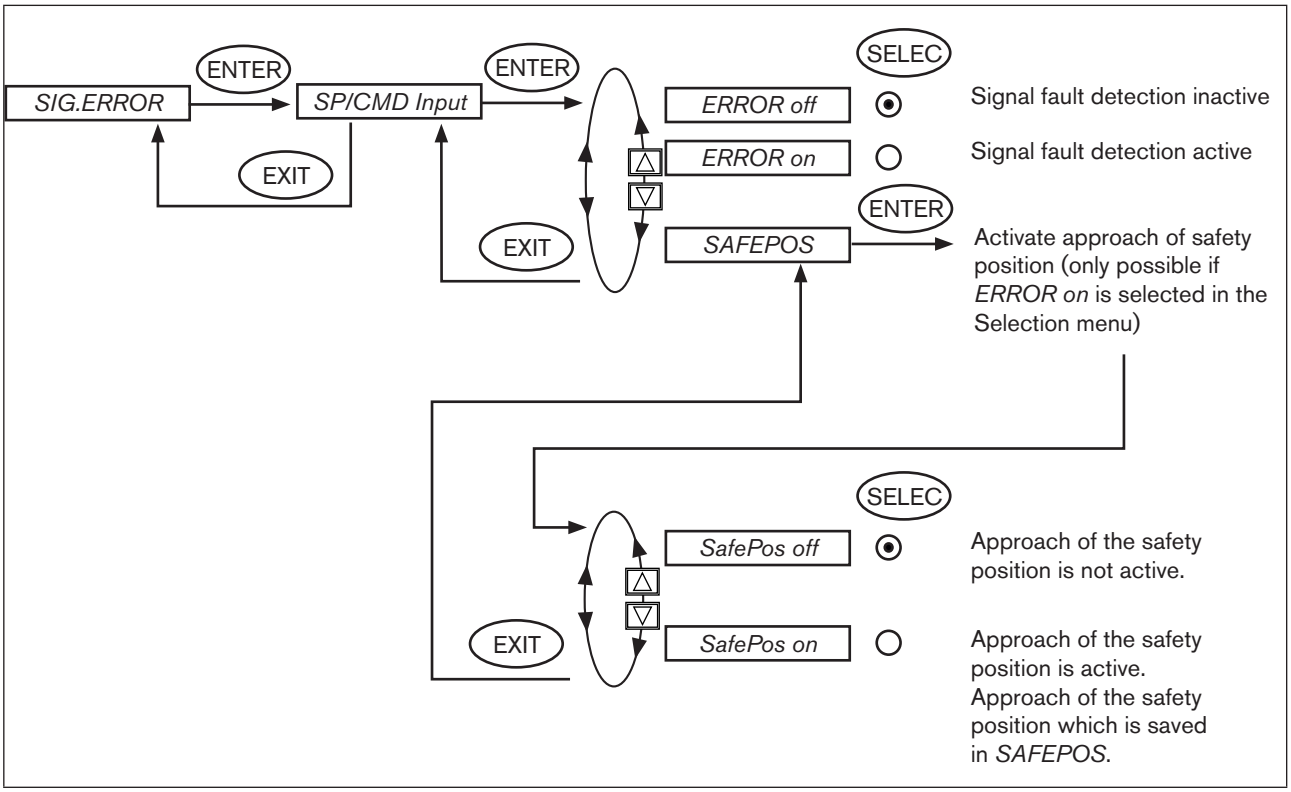

Fig. 31: Operating structure SIG-ERROR

If signal fault detection is activated, the respective fault is indicated on the display.
(see chapter entitled "*Maintenance and troubleshooting*")

Safety position *SAFEPOS on*

When *SAFEPOS on* is set, the following configurations may occur:

Active *SAFEPOS* menu option
If a fault is detected, the actuator moves to the lower *SAFEPOS* set position.

Inactive menu option *SAFEPOS*
If a fault is detected, the actuator moves to the end position which it would specify in the isolated state.

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4.3.12 *BINARY-IN*
Activation of the binary input

This function activates the binary input.

The following settings can be implemented for this:

- Approaching the safety position

or

- Switching over the MANUAL/AUTOMATIC operating mode

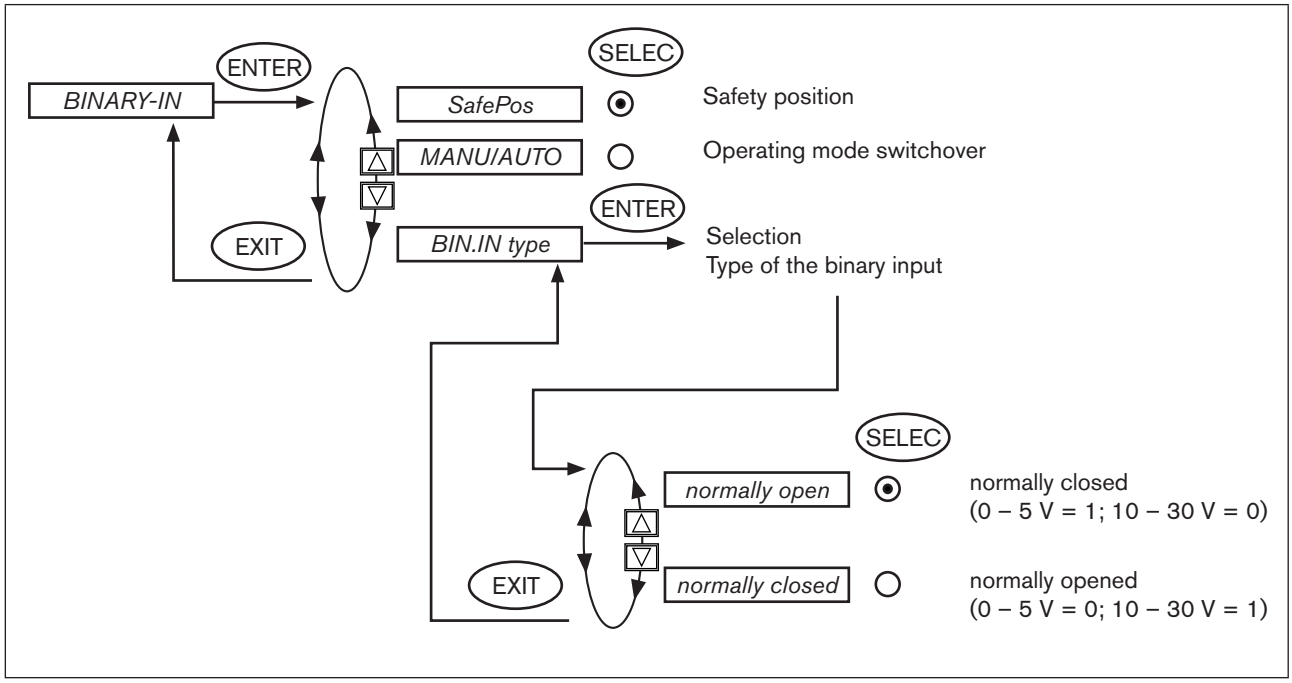

Fig. 32: Operaring structure BINARY-IN

Safety position *SAFEPOS*

Approach of a safety position.

Active *SAFEPOS* menu option
The actuator moves to the lower *SAFEPOS* set position.

Inactive *SAFEPOS* menu option
The actuator moves to the end position which it would specify in the isolated state.

Operating mode switchover MANU/AUTO

Switch over the operating state to MANUAL or AUTOMATIC.

Binary input = 0 → AUTOMATIC operating mode

Binary input = 1 → MANUAL operating mode

If operating mode switchover is selected, you can no longer switch over the operating mode via the selection key on the right (MANU/AUTO).

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4.3.13 *OUTPUT* (option)
Configuring the outputs

The *OUTPUT* menu option is only indicated in the selection menu of *ADD.FUNCTION* if the positioner has outputs (option).

The outputs can be used for the following feedback signals:

Analogue output:	Feedback signal of the current position (*POS*) or of the set-point value (*CMD*) to the control centre.
Binary outputs:	Alarm output for excessively large control deviations of the position controller or for the output of the current position with respect to a specified limit position (> or <) or for the output: actuator in safety position or for the output: sensor break or for the output: operating state (AUTOMATIC / MANUAL).

The positioner which has the outputs option is available in the following versions:

- one analogue output
- one analogue and two binary outputs
- two binary outputs

According to the version of the positioner only the possible adjustable outputs (*ANALOGUE, ANALOGUE + BIN 1 + BIN 2 or BIN 1 + BIN 2*) are indicated in the OUTPUT menu option.

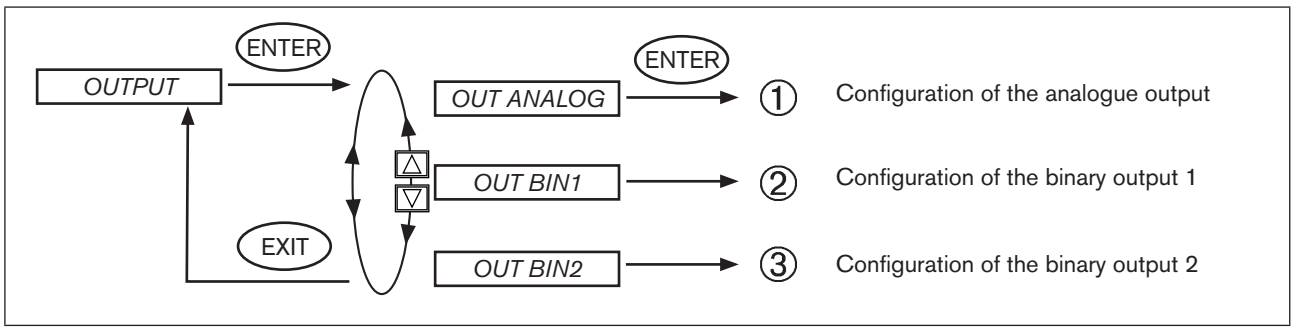

Fig. 33: Operating structure OUTPUT

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① *OUT ANALOG* - Configuration of the analogue output

Only for the versions:
- one analogue output
- one analogue and two binary outputs

The feedback signal of the current position (*POS*) or of the set-point value (*CMD*) can be transmitted to the control centre via the analogue output.

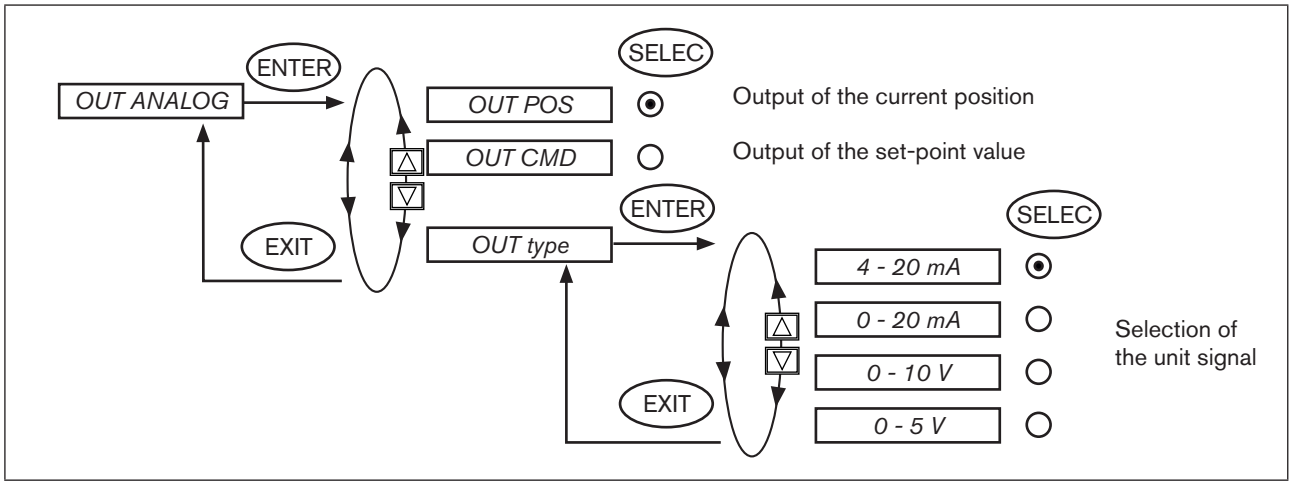

Fig. 34: Operating structure OUTPUT-ANALOGUE

Changed values are not transferred into the memory (EEPROM) until the main menu (MAIN) is left.

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② ***OUT BIN1*** **- Configuration of the binary output 1**

③ ***OUT BIN2*** **- Configuration of the binary output 2**

The following description is valid for both binary outputs *OUT BIN 1* and *OUT BIN 2*, as the operation in the menu is identical.

The binary outputs 1 and 2 can be used for one of the following outputs:

- Alarm output for excessively large control deviations of the position controller
- for the output of the current position with respect to a specified limit position (> or <)
- for the output: actuator in safety position
- for the output: sensor break
- for the output: operating state (AUTOMATIC / MANUAL)

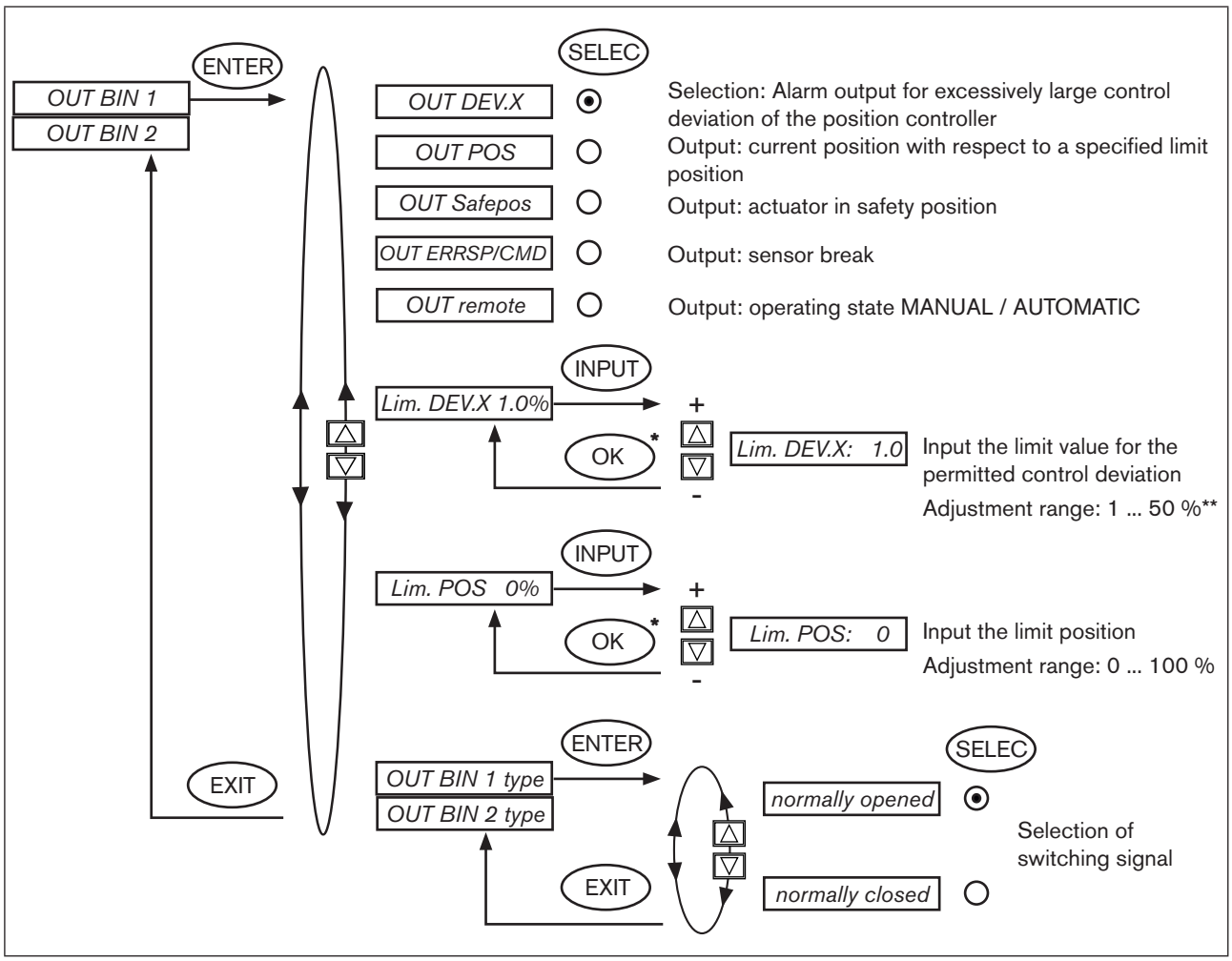

Fig. 35: Operating structure OUTPUT-BIN1

Normally closed output, in switched state *low* (≙ 0 V)
Normally opened output, in switched state *high* (≙ 24 V)

Changed values are not transferred into the memory (EEPROM) until the main menu (MAIN) is left.

* *If the sub-menu is left by pressing the selection key on the left (ESC), the value remains unchanged.*

** *The permitted control deviation Lim DEV.X XX must not be less than the dead band.*

Alarm output for excessively large control deviation of the position controller: *OUT DEV.X*

→ Press the arrow keys to mark the *OUT DEV.X* menu option and confirm with the selection key on the right (SELEC).

→ Press the arrow keys to input the limit value for the permitted control deviation in the Lim. DEV.X menu option and accept with the selection key on the right (OK).

The permitted control deviation *Lim. DEV.X XX* must not be less than the dead band.

→ In the *OUT BIN type* menu option input the required switching status (*normally opened* / *normally closed*)*.

Output of the current position with respect to a specified limit position: *OUT POS*

→ Press the arrow keys to mark the *OUT POS* menu option and confirm with the selection key on the right (SELEC).

→ Press the arrow keys to input the the value of the limit position in the Lim. POS 0% menu option and accept with the selection key on the right (OK).

→ In the *OUT BIN type* menu option input the required switching status (*normally opened* / *normally closed*).

OUT BIN1	*normally opened*	*normally closed*
POS > LIM	0 V	24 V
POS < LIM	24 V	0 V

Output of message: Actuator in safety position: *OUT Safepos*

→ Press the arrow keys to mark the *OUT Safepos* menu option and confirm with the selection key on the right (SELEC).

→ In the *OUT BIN type* menu option input the required switching status (*normally opened* / *normally closed*)*.

Output sensor break: *OUT ERR SP/CMD*

→ Using the arrow keys, mark the *OUT ERR SP/CMD* menu option and confirm with the selection key on the right (SELEC).

→ In the *OUT BIN type* menu option input the required switching status (*normally opened* / *normally closed*)*.

Output operating state AUTOMATIC / MANUAL: *OUT remote*

→ Using the arrow keys, mark the *OUT remote* menu option and confirm with the selection key on the right (SELEC).

→ In the *OUT BIN type* menu option input the required switching status (*normally opened* / *normally closed*).

OUT BIN1	*normally opened*	*normally closed*
AUTOMATIC operating state	0 V	24 V
MANUAL operating state	24 V	0 V

* *Normally closed* output, in switched state *low* (≅ 0 V)
Normally opened output, in switched state *high* (≅ 24 V)

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4.3.14 *CAL.USER*
Calibrating the actual value display and the inputs for the position set-point value

The following points can be manually calibrated with this function:

- Position display (*POS*) 0 – 100%
- Position set-point value display (*INPUT*)

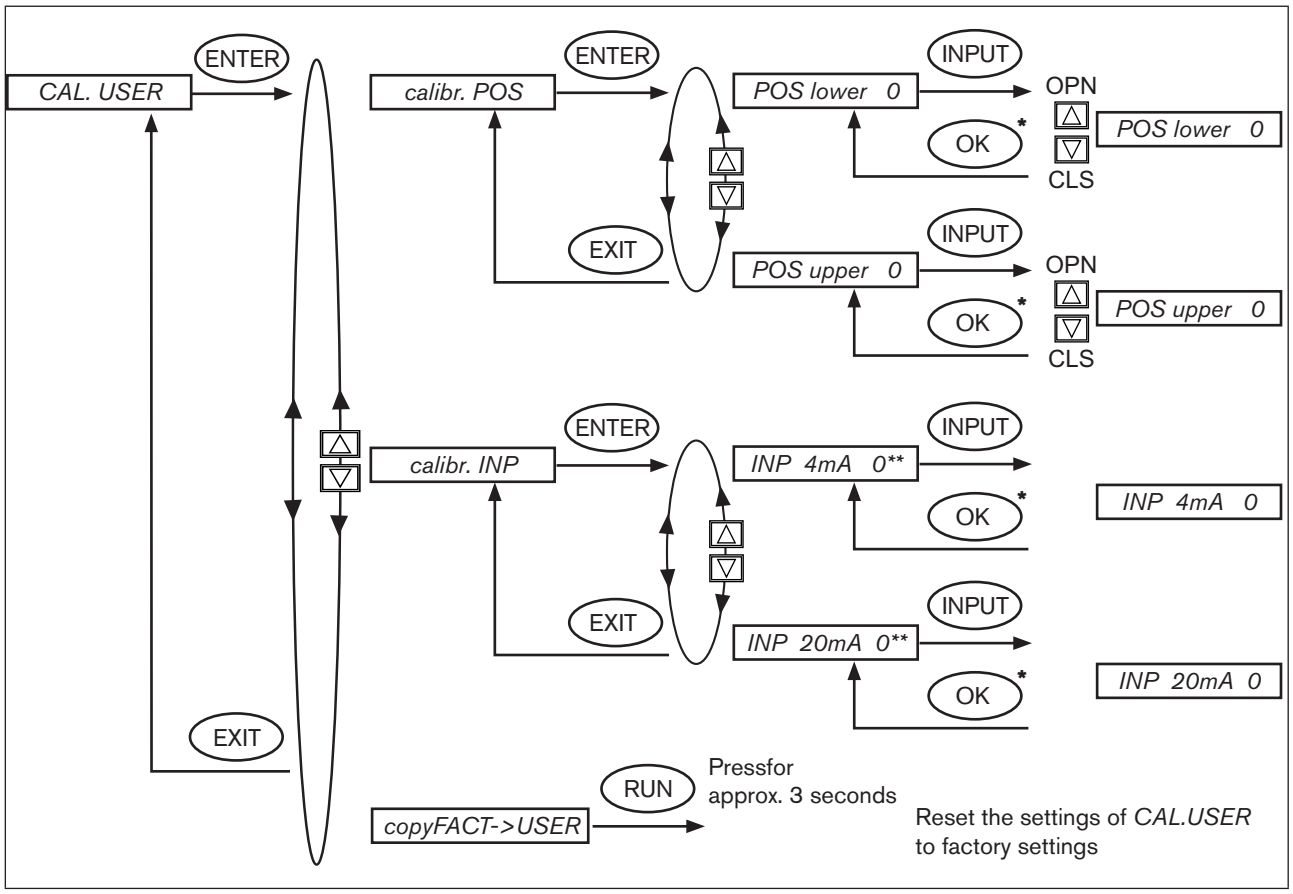

Fig. 36: Operating structure CAL.USER

Remove the *CAL.USER* auxiliary function to re-activate the factory calibration.

* *If the sub-menu is left by pressing the selection key on the left (ESC), the value remains unchanged.*

** *The signal type is displayed which is selected in the INPUT menu (4 – 20 mA; 0 – 20 mA; 0 – 5 V; 0 – 10 V).*

Procedure:

Calibrating the actual value display *POS* (0 - 100 %): *calibr. POS*

→ In the *CAL. USER* menu press the arrow keys to select the *calibr. POS* menu option and confirm with the selection key on the right (ENTER).

Accept the minimum position:

→ Press the arrow keys to select the *POS lower X* menu option and confirm with the selection key on the right (INPUT).

→ Approach the minimum position of the valve using the arrow keys (OPN/CLS) and confirm this value by pressing the selection key on the right (OK).

Accept the maximum position:

→ Press the arrow keys to select the *POS upper X* menu option and confirm with the selection key on the right (INPUT).

→ Approach the maximum position of the valve using the arrow keys (OPN/CLS) and confirm this value by pressing the selection key on the right (OK).

Calibrating the position set-point value (4 – 20 mA; 0 – 20 mA; 0 – 5 V; 0 – 10 V): *calibr. INP*

→ In the *CAL. USER* menu press the arrow keys to select the *calibr. INP* menu option and confirm with the selection key on the right (ENTER).

Accept the minimum input signal (0 mA; 4 mA; 0 V):

→ Using the arrow keys, select the *INP (0 mA; 4 mA; 0 V)* menu option and confirm with the selection key on the right (INPUT).

→ Apply the minimum value of the unit signal on the input and confirm by pressing the selection key on the right (OK).

Accept the maximum input signal (20 mA; 5 V; 10 V):

→ Using the arrow keys, select the *INP (20 mA; 5 V; 10 V)* menu option and confirm with the selection key on the right (INPUT).

→ Apply the maximum value of the unit signal on the input and confirm by pressing the selection key on the right (OK).

Resetting the settings under *CAL.USER* to the factory settings: *copy FACT→USER*

→ In the *CAL. USER* menu select the *copy FACT→USER* menu option using the arrow keys and confirm with the selection key on the right (ENTER).

→ Hold down the selection key on the right (RUN) (for approx. 3 seconds) until the countdown has elapsed.

4.3.15 *SET.FACTORY*
Resetting to the factory settings

This function allows all settings implemented by the user to be reset to the delivery status.

All EEPROM parameters with the exception of the calibration values are reset to default values. Then a hardware reset is implemented.

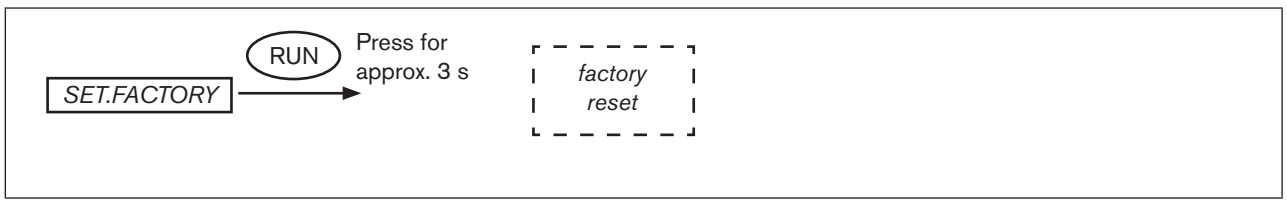

Fig. 37: Operating structure SET.FACTORY

→ To activate the *SET.FACTORY* function, hold down the selection key on the right (RUN) for approx. 3 s until the countdown has elapsed.

To adjust the positioner to the operating parameters, re-implement self-parameterisation of the position controller (*X.TUNE*).

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4.3.16 *SER. I\O*
Settings of the serial interface

This function can be used to set the type of the serial interface and the baud rate.

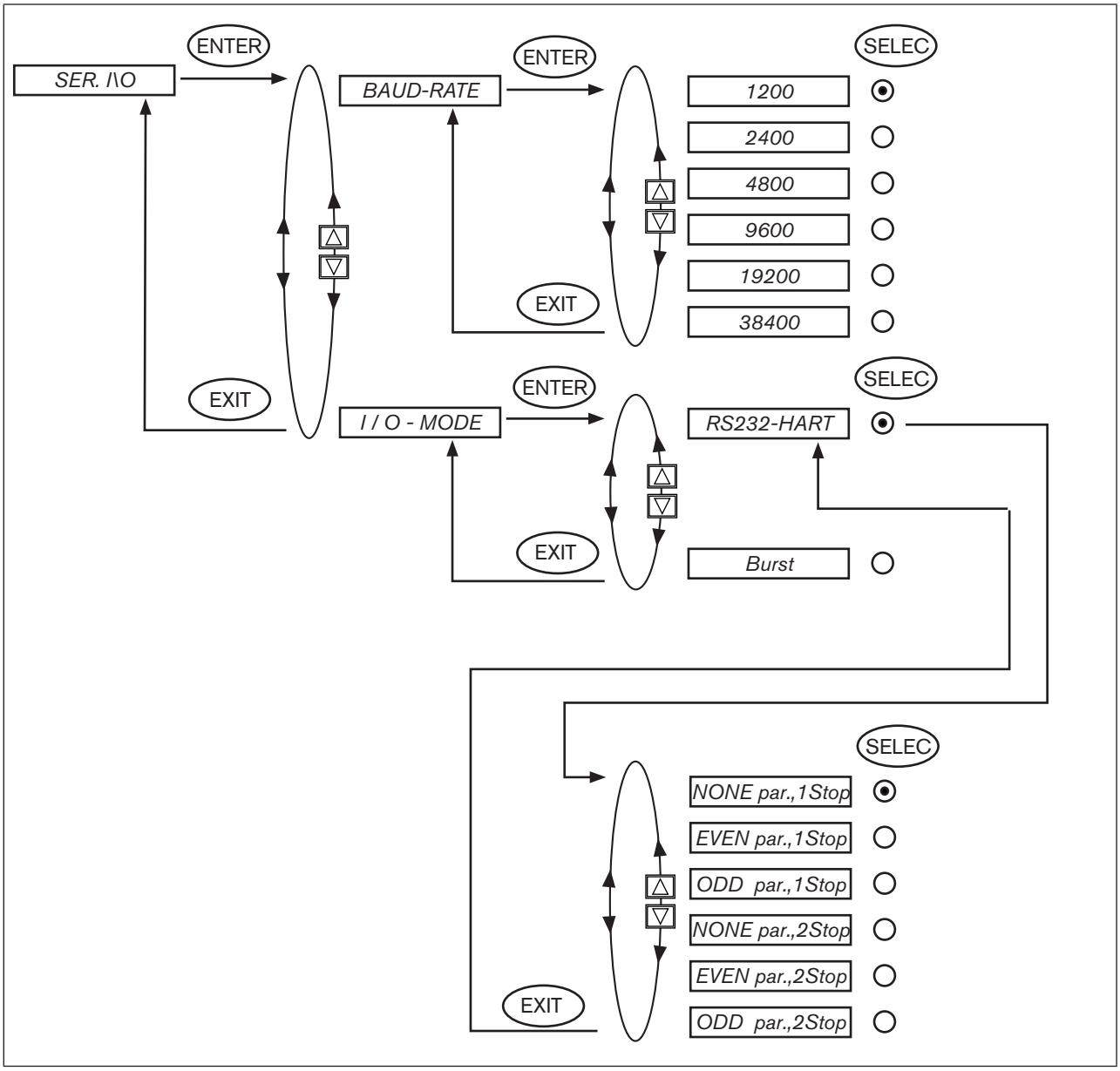

Fig. 38: Operating structure SER. I\O

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4.3.17 *EXTRAS*

This function can be used to set the representation on the display.

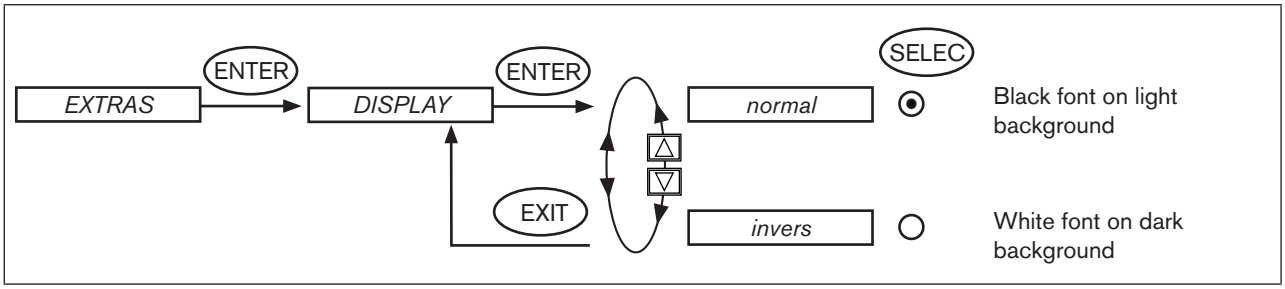

Fig. 39: Operating structure EXTRAS

4.3.18 *SERVICE*

This function is of no importance to the operator of the positioner. It is for internal use only.

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Start-up and operation of the position controller Type 8693

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1 SAFETY INSTRUCTIONS

DANGER!

Danger – high pressure in the equipment!

There is a serious risk of injury when reaching into the equipment.

- Before loosening the lines and valves, turn off the pressure and vent the lines.

WARNING!

Danger - improper installation!

Improper installation may result in injuries as well as damage to the device and the area around it.

- Fluid and electrical installations may be carried out by authorised technicians only and with the appropriate tools!

Danger due to unintentional activation of the equipment!

Unintentional activation of the equipment during installation may result in injuries and damage.

- Take appropriate measures to prevent the equipment from being unintentionally activated.

2 STARTING UP AND SETTING UP THE PROCESS CONTROLLER TYPE 8693

→ Before starting up the device, carry out the fluid and electrical installations as described in the chapter entitled *"Installation"*.

To set up the positioner as a process controller, it is first necessary to specify the basic functions of the position controller and then supplement the auxiliary functions for the process control.

2.1 Description of the procedure

When the operating voltage has been switched on, the positioner is at the process operating level in the AUTOMATIC operating state.

To specify the basic settings, you must switch to the configuration level:

→ Hold down the left selection key (MENU) for approx. 3 seconds (wait for countdown on display).

Then the main menu is indicated on the display (MAIN).

→ Press the arrow keys to switch between the main menu options and select a menu option with the right selection key (ENTER/RUN).

Depending on the function, a menu sub-option or a selection screen is indicated on the display.

→ Press the arrow keys to switch between these sub-options and select the required settings. Press the right selection key (SELEC/ENTER) to confirm the selection (the point after the selected parameter is now marked). Return to the main menu by pressing the left selection key (EXIT).

→ To save the changed settings, you must leave the configuration level by pressing the left selection key (EXIT).

You are back at the process operating level.

Only when you leave the configuration level by pressing the right selection key, are the changed parameters and settings saved (*"save EEPROM"*).

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2.2 Factory settings of the process controller

Function	Factory setting	Function	Factory setting
P.CONTROL		*SETUP*	
PARAMETER		*PV-INPUT*	*4-20 mA*
DBND	*1.0 %*	*PV SCALE*	*PVmin 0.0*
KP	*1.00*		*PVmax 100.0*
TN	*999.9*	*SP-INPUT*	*internal*
TV	*0.0*	*P.CO-INIT*	*bumpless*
X0	*0.0 %*		
FILTER	*0*		

The factory settings of the position controller can be found in the chapter entitled *"Start-up and operation of the position controller Type 8692" - "Factory settings of the position controller"*.

2.3 Procedure for setting up a process control

CAUTION!

The process control cannot be implemented until the position controller has been automatically adjusted *(X.TUNE)*!

- Always observe the following sequence: *X.TUNE* → *P.Q'LIN*

To operate the positioner as a process controller, implement the following steps:

Setting up the position controller:

A → Specify the standard settings of the positioner and automatically adjust the position controller (*X.TUNE*).

Setting up the process controller:

B → Start the *P.CONTROL* auxiliary function via the configuration menu in the main menu.
The *P.CONTROL* function also inserts the *P.Q'LIN* function into the main menu.

C → Implement the standard settings for the process controller under *P.CONTROL*.

D Linearisation of the process characteristic
If this is a flow control process, the process characteristic can be linearised automatically:
→ Implement the *P.Q'LIN* function.

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2.4 Setting up the position controller

A

Specification of the basic settings is described in the chapter entitled *"Start-up and operation of the position controller Type 8692" - "Specifying the basic settings"*.

When starting up the positioner for the first time, implement the following basic settings:

→ Specify the selected unit signal input for the set-point value default (*INPUT*)
(4 – 20 mA, 0 – 20 mA, 0 – 10 V or 0 – 5 V).

→ Start automatic adjustment of the position controller to the particular operating conditions (*X.TUNE*).

The exact description of the functions *INPUT* and *X.TUNE* can be found in the chapter entitled *"Start-up and operation of the position controller Type 8692" -"Description of the functions of the main menu"*.

The basic settings for the positioner are implemented at the factory. During start-up, however, it is essential to input the unit signal (*INPUT*) and run *X.TUNE* . Using the *X.TUNE* function, the positioner automatically determines the optimum settings for the current operating conditions.

2.5 Setting up the process controller

2.5.1 Starting the *P.CONTROL* auxiliary function

B

How to start the auxiliary functions is described in the chapter entitled *"Start-up and operation of the position controller Type 8692" - "Configuring the auxiliary functions"*.

→ Press the left selection key (MENU) to switch to the configuration level in the main menu (MAIN).

→ Press the arrow keys to select the *ADD.FUNCTION* menu option and confirm by pressing the right selection key (ENTER).

→ Press the arrow keys to select the *ADD.FUNCTION* menu option and confirm by pressing the right selection key (ENTER).

→ Press the left selection key (EXIT) to return to the main menu.

The main menu now contains the *P.CONTROL* and *P.Q'LIN* auxiliary functions.

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2.5.2 Basic settings for the *P.CONTROL* function

Ⓒ

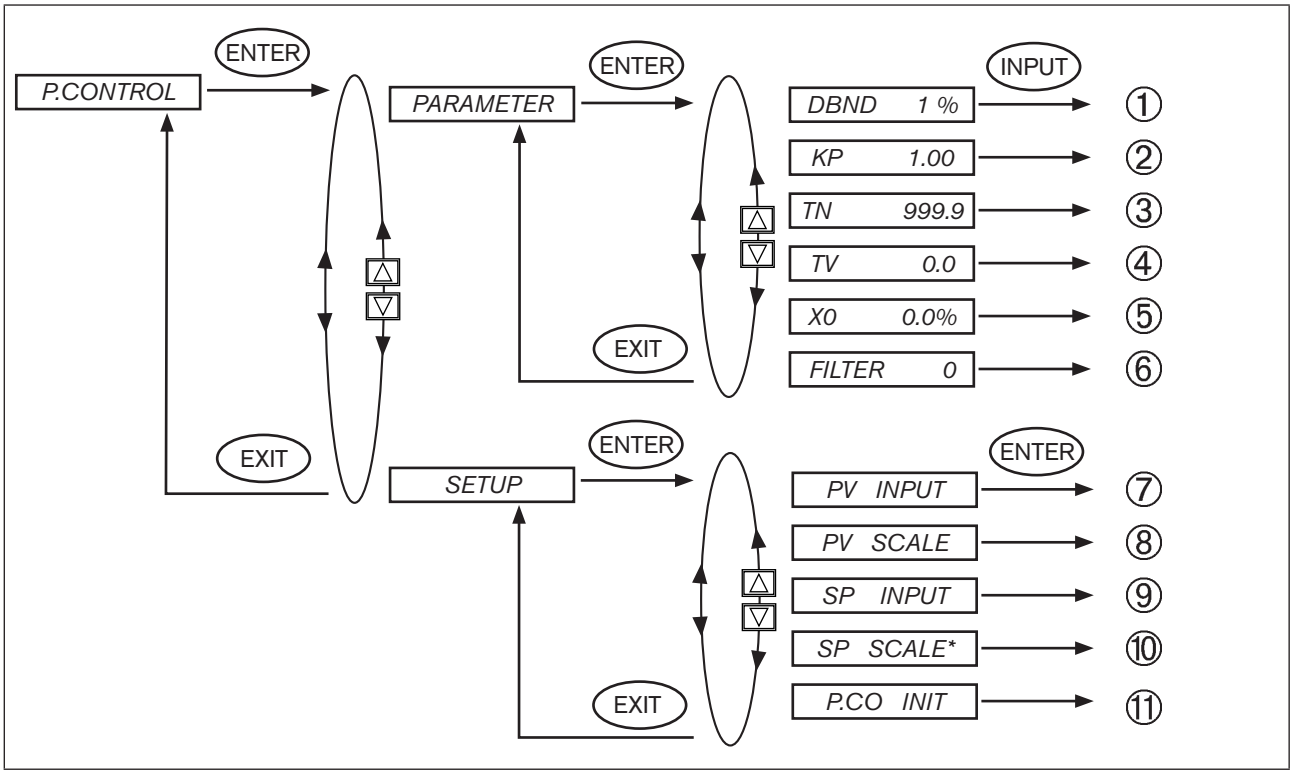

Fig. 1: Operating structure P.CONTROL

①	Insensitivity area (dead band) of the PID process controller
②	Amplification factor of the process controller
③	Reset time
④	Hold-back time
⑤	Working point
⑥	Filtering of the process actual value input

⑦	Indication of the signal type for process actual value
⑧	Scaling the process controller
⑨	Type of the set-point value default (internal or external)
⑩	Scaling the position controller (for external set-point value default only)
⑪	Enables a smooth switchover between AUTOMATIC and MANUAL mode

* *The SP SCALE function is indicated only if the external set-point value default (external) menu option is activated under SP INPUT.*

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2.5.3 Parameter setting of the process controller - *PARAMETER*

These positioner functions are used to specify the control parameters of the process controller.

The basic principles of setting a controller can be found in the chapter entitled *"General rules" - "Properties of PID controllers"*.

① *DBND* - Insensitivity area (dead band) of the process controller

This function causes the process controller to respond from a specific control difference only. This protects both the solenoid valves in the positioner and the pneumatic actuator.

Factory setting: 1.0 % (with reference to the range of the process actual value scaled by *PV SCALE - PVmin* and *PVmax*)

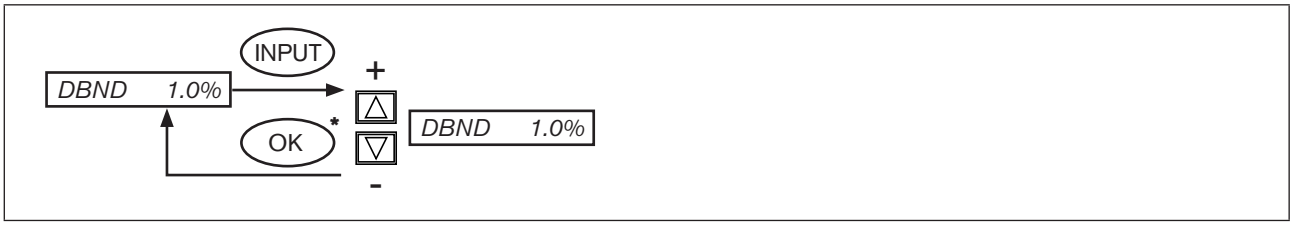

Fig. 2: Operating structure P.CONTROL - DBND

Insensitivity area for process control

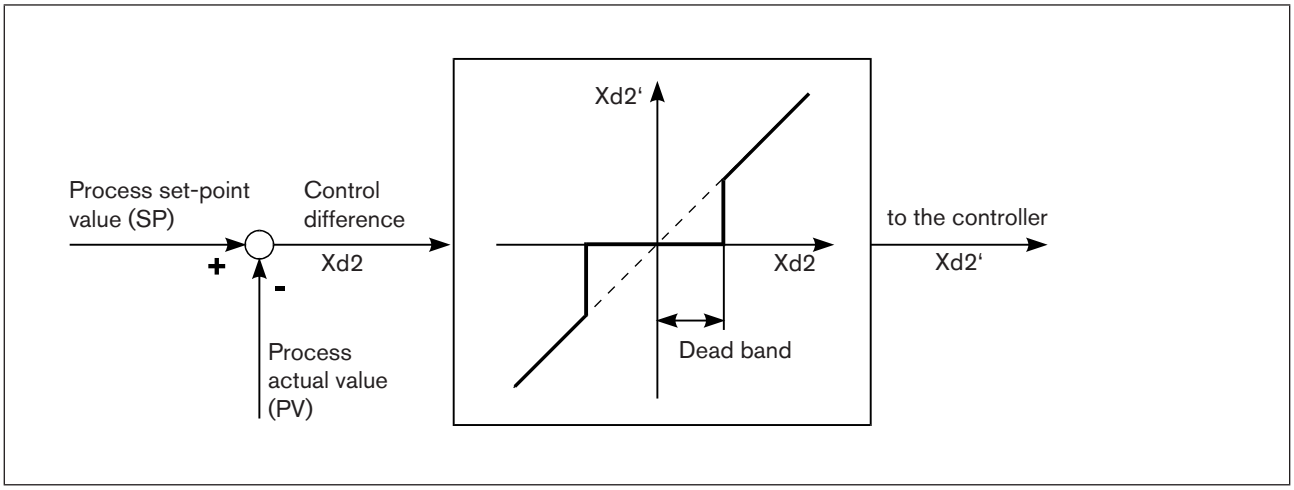

Fig. 3: Operating structure P.CONTROL - DBND

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** If the sub-menu is left by pressing the selection key on the left (ESC), the value remains unchanged.*

② *KP* - Amplification factor of the process controller

The amplification factor specifies the P-contribution of the PID controller.

Factory setting: 1.00

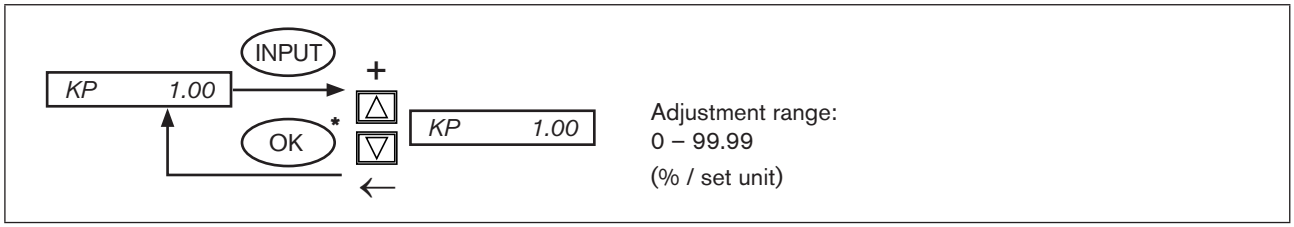

Fig. 4: Operating structure P.CONTROL - KP

The *KP* amplification of the process controller refers to the scaled unit.

③ *TN* - Reset time of the process controller

Specifies the I-contribution of the PID controller.

Factory setting: 999.9 s

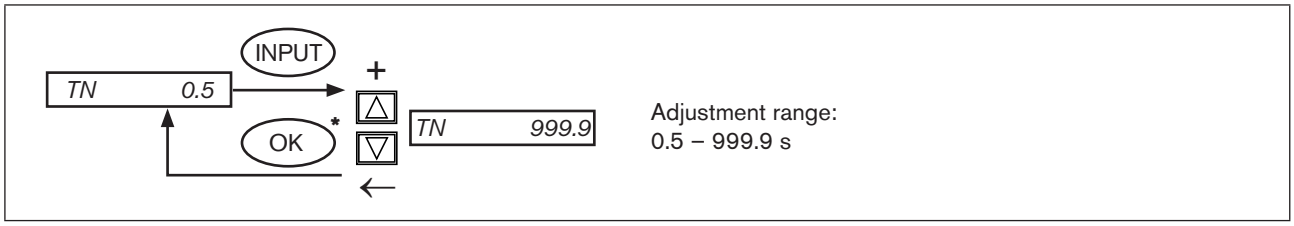

Fig. 5: Operating structure P.CONTROL - TN

④ *TV* - Hold-back time of the process controller

Specifies the D-contribution of the PID controller.

Factory setting: 0.0 s

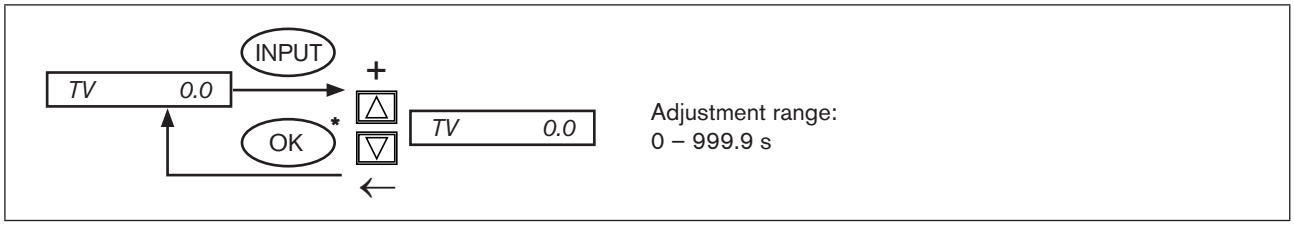

Fig. 6: Operating structure P.CONTROL - TV

** If the sub-menu is left by pressing the selection key on the left (ESC), the value remains unchanged.*

⑤ *X0* - Working point of the process controller

Operating point in rest state.

Factory setting: 0.0 %

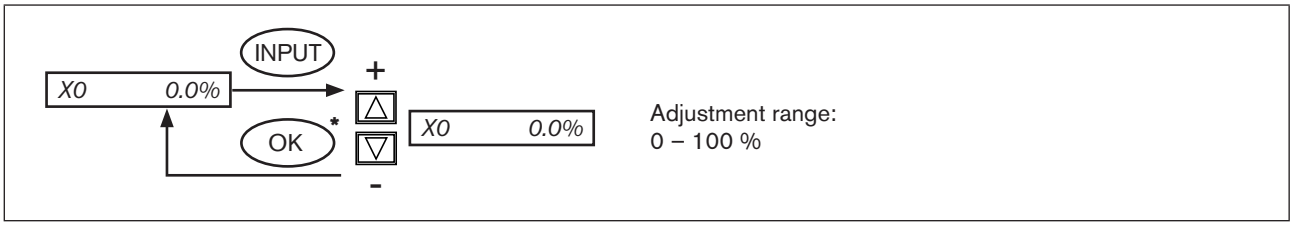

Fig. 7: Operating structure P.CONTROL - X0

The "*Process controller tables*" appendix contains a table *"Set parameters of the process controller"* in which you can enter your parameters.

⑥ *FILTER* - Filtering of the process actual value input

The filter is valid for all process actual value types and has a low pass behaviour (PT1).

Factory setting: 0

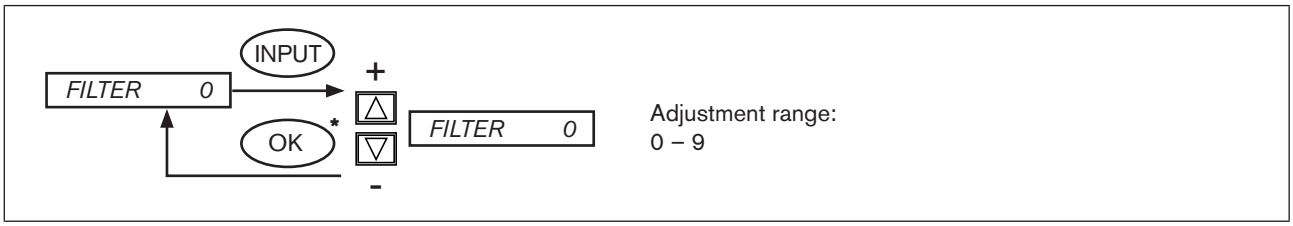

Fig. 8: Operating structure P.CONTROL - FILTER

Setting in 10 stages

Setting	Corresponds to limit frequency (Hz)	Effect
0	10	Lowest filter effect
1	5	
2	2	
3	1	
4	0.5	
5	0.2	
6	0.1	
7	0.07	
8	0.05	
9	0.03	Largest filter effect

** If the sub-menu is left by pressing the selection key on the left (ESC), the value remains unchanged.*

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2.5.4 Setting up the process controller - *SETUP*

These functions specify the type of control.

⑦ *PV INPUT* - Indication of the signal type for the process actual value

The *PV INPUT* function specifies the signal type of the process actual value:

▪ Unit signal	4 ... 20 mA	Flow, pressure, level
▪ Frequency signal	0 ... 1,000 Hz	Flow
▪ Circuit with PT 100	-20 °C – +220 °C	temperature

Factory setting: 4 ... 20 mA

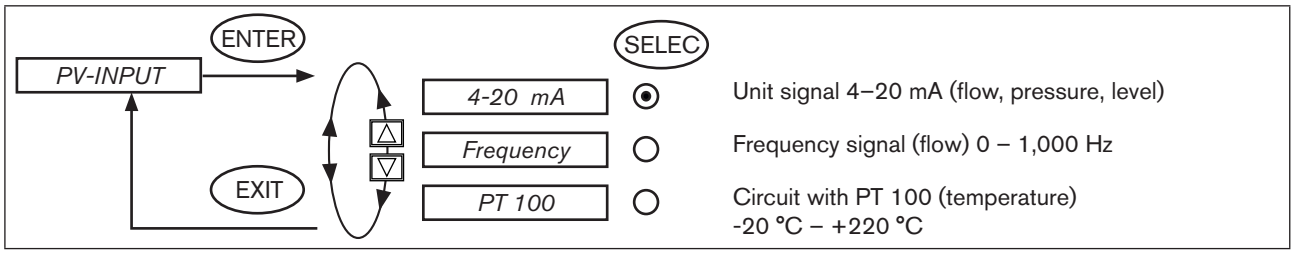


Fig. 9: Operating structure P.CONTROL - PV-INPUT

⑧ *PV-SCALE* - Scaling of the process controller

The *PV-SCALE* function specifies the following settings:

- The unit of the process actual value.
- The position of the decimal point.
- The values for the lower and upper process actual value.

If the settings for the unit of the process actual value or the position of the decimal point are input or changed, this setting applies to all scaling values (*SPmin, SPmax, PVmin, PVmax*).

Procedure for setting the scaling values

Inputting the unit and the position of the decimal point for the scaling values (possible in *PVmin* only):

→ Press the arrow keys to select the *PV SCALE* menu option and confirm by pressing the right selection key (ENTER).

→ Press the right selection key (INPUT) to enter the input screen for *PVmin*.

On the display the field for the unit has a dark background and is therefore marked.

→ Press the up arrow key (+) to select the unit (bar, mbar, ... °F)* of the scaling values.

→ Press the down arrow key (←) to change the dark highlighted background to the decimal point of the value which specifies the position of the decimal point with the aid of the up arrow key (+).

Inputting the scaling value:

→ Press the down arrow key (←) to change the dark highlighted background to the last digit of the value.

→ Press the up arrow key (+) to specify the individual digits of the value and switch to the next digit with the down arrow key (←).

→ When all input values have been specified, confirm by pressing the right selection key (OK) and jump back to the selection screen.

** The units indicated here depend on the signal type (PV INPUT).*

⑧ -1- *PV-SCALE - 1* - Scaling of the process controller for signal type 4 – 20 mA *(PV-INPUT 4 - 20 mA)*

With the *PV-SCALE* function for signal type 4 – 20 mA the following settings are specified:

- The unit of the process actual value.
- The position of the decimal point.
- The values for the lower and upper process actual value are assigned to the respective current value of the unit signal.

If the settings for the unit of the process actual value or the position of the decimal point are input or changed, this setting applies to all scaling values (*PVmin, PVmax, SPmin, SPmax*).

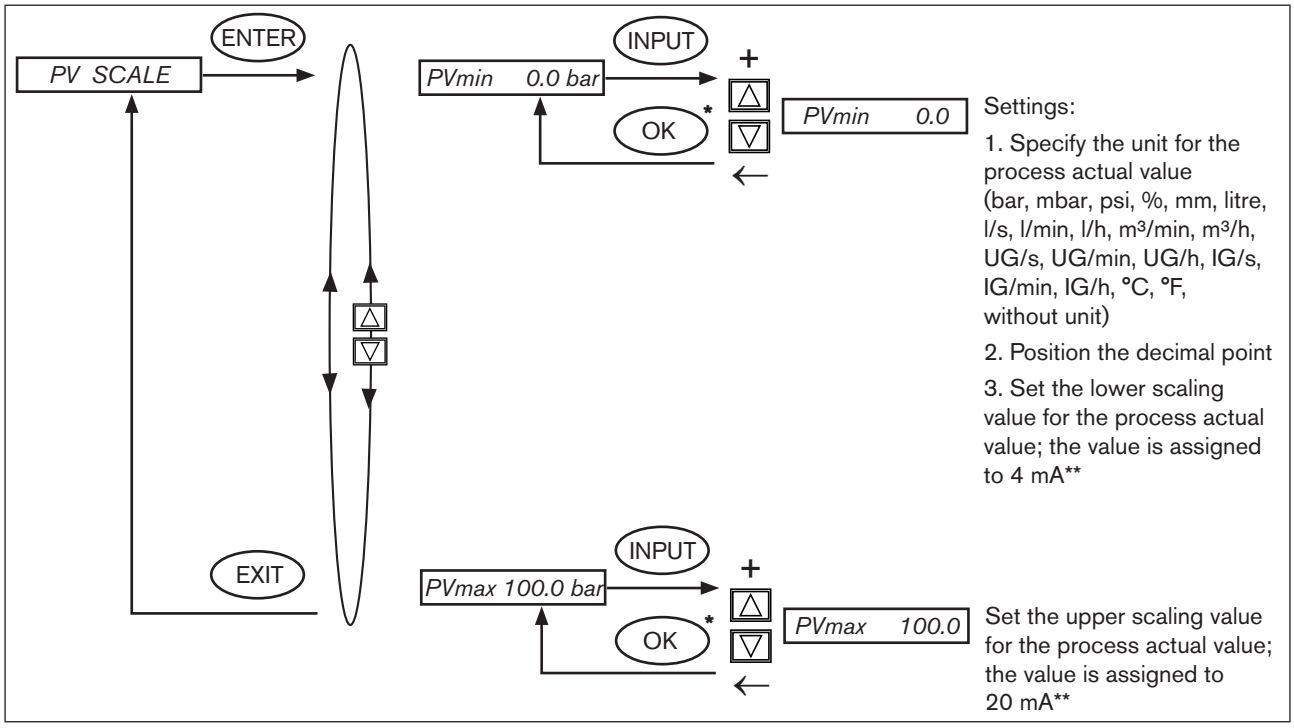
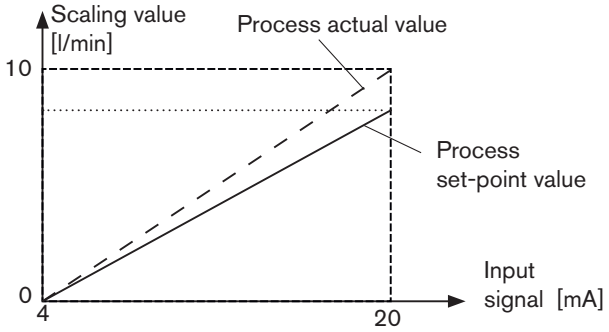


Fig. 10: Operating structure P.CONTROL - PV-SCALE - 4-20mA

Scaling example of the 4 – 20 mA input

Process actual value from the transmitter: 4 ... 20 mA corresponds to 0 – 10 l/min

Process set-point value from PLC: 4 ... 20 mA corresponds to 0 – 8 l/min



Example of inputting scaling values

	Variant 1	Variant 2	Variant 3
PVmin	0	0	0
PVmax	1.0	10.0	100.0
SPmin	0	0	0
SPmax	0.8	8.0	80.0

For SP INPUT internal (set-point value default via the arrow keys) the scaling of the set-point value via SPmin and SPmax is not possible. The set-point value can be input directly according to the scaled process variable (PVmin, PVmax).

* *If the sub-menu is left by pressing the selection key on the left (ESC), the value remains unchanged.*

** *This setting specifies the reference range for the dead band of the process controller as well as for the analogue feedback of the process actual value (option).*

⑧ -2- *PV-SCALE - 2* - Scaling of the process controller for frequency input signal type *(PV INPUT frequency)*

The *PV-SCALE* function specifies the following settings for frequency input signal type:

- The unit of the process actual value.
- The position of the decimal point.
- The values for the lower and upper process actual value.
- The K-factor.

If the settings for the unit of the process actual value or the position of the decimal point are input or changed, this setting applies to all scaling values (*PVmin, PVmax, SPmin, SPmax*).

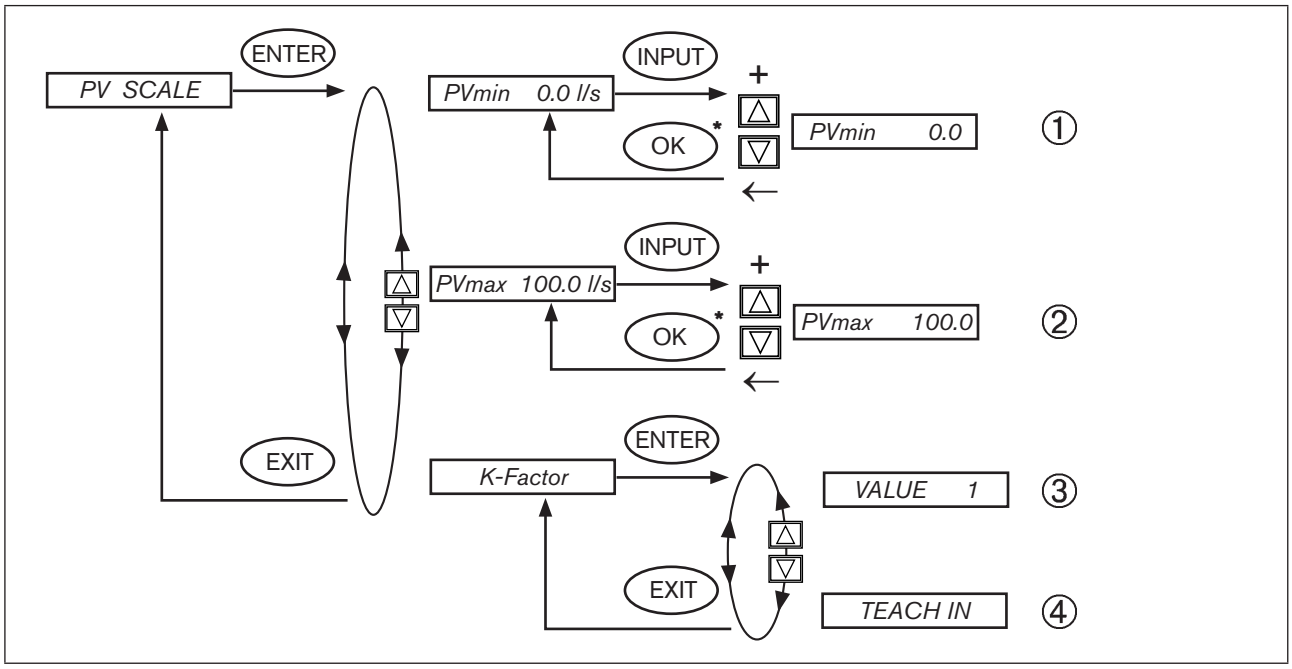


Fig. 11: Operating structure P.CONTROL - PV-SCALE - Frequency

① PVmin X x/x

Lower scaling value for the process actual value

Settings:

1. Select the unit for the flow

The unit on the display has a dark background. Press the up arrow key (+) to select from the following units:

l/s, l/min, l/h, m³/min, m³/h, UG/s (gal(US)/s), UG/min (gal(US)/min), UG/h (gal(US)/h), IG/s (gal(Imperial)/s), IG/min (gal(Imperial)/min), IG/h (gal(Imperial)/h).

2. Input the position of the decimal point

Press the down arrow key (←) to highlight the decimal point with a dark background. Press the up arrow key (+) to specify the position.

3. Input the lower scaling value for the process actual value

Press the down arrow key (←) to highlight the individual positions with a dark background. Press the up arrow key (+) to set the value.

Adjustment range: 0 ... 9999

This setting specifies the reference range for the dead band of the process controller as well as for the analogue feedback of the process actual value (option).

** If the sub-menu is left by pressing the selection key on the left (ESC), the value remains unchanged.*

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② *PVmax X x/x*

Upper scaling value for the process actual value

Settings:

The unit for flow and the position for the decimal point is transferred from the inputs of the lower scaling value.

1. Input the upper scaling value for the process actual value

Press the down arrow key (←) to highlight the individual positions with a dark background. Press the up arrow key (+) to set the value.

Adjustment range: 0 ... 9999

This setting specifies the reference range for the dead band of the process controller as well as for the analogue feedback of the process actual value (option).

K-Factor

③ *VALUE X*

Manually inputting the K-factor for the flow sensor

(e.g.from the data sheet of the flow sensor)

1. Input the position of the decimal point

The decimal point on the display has a dark background. Press the up arrow key (+) to specify the position.

Adjustment range: 1 or 2

2. Input the K-factor

Press the down arrow key (←) to highlight the individual positions with a dark background. Press the up arrow key (+) to set the value.

Adjustment range: 0 ... 9999

④ *TEACH IN*

Teach-in function:

Calculating the K-factor by measuring a specific flow rate.

→ Hold down the selection key on the right (ENTER) for approx. 3 s (countdown on display)

When this menu is entered, the valve is closed in order to have a defined initial state for implementation of the Teach-in function.

Starting the measurement

→ Press the selection key on the right (START) to start the measurement (the message "*Teach-in at work" is displayed briefly).*

The valve is opened and the container is filled ("→ *fill ..*" is indicated on the display).

Ending the measurement

→ Press the selection key on the right (STOP) to complete the measurement and to display the input screen for the volume.

Inputting the position of the decimal point

The decimal point on the display has a dark background.

→ Press the up arrow key (+) to specify the position.

Inputting the measured volume

→ Press the down arrow key (←) to highlight the individual positions with a dark background. Press the up arrow key (+) to set the value.

Adjustment range: 0 ... 9999

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⑧ -3- *PV-SCALE - 3* - Scaling of the process controller for selection of the Pt 100 input *(PV INPUT PT 100)*

The *PV-SCALE* function specifies the following settings for the PT 100 signal type:

- The unit of the process actual value.
- Position of the decimal point.
- The values for the lower and upper process actual value.

If the settings for the unit of the process actual value or the position of the decimal point are input or changed, this setting applies to all scaling values (*PVmin, PVmax, SPmin, SPmax*).

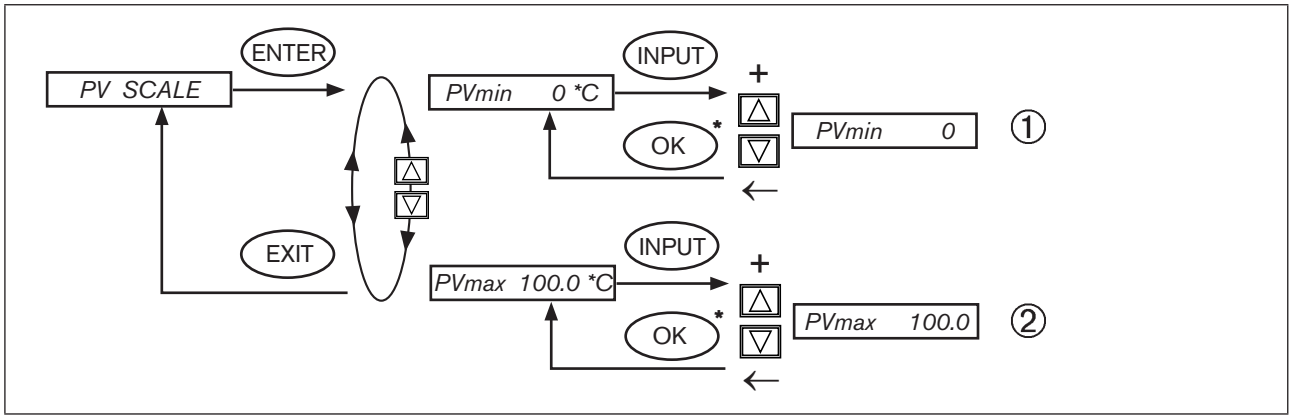

Fig. 12: Operating structure P-CONTROL-PV-SCALE - PT100

① PVmin X *X

Lower scaling value for the process actual value

Settings:

1. Select the unit for the temperature

The unit on the display has a dark background. Press the up arrow key (+) to select from the following units:

°C or °F.

2. Input the position of the decimal point

Press the down arrow key (←) to highlight the decimal point with a dark background. Press the up arrow key (+) to specify the position.

Adjustment range: 1 or 2

3. Input the lower scaling value for the process actual value

Press the down arrow key (←) to highlight the individual positions with a dark background. Press the up arrow key (+) to set the value.

Adjustment range: -200 ... 800

Measurement range of the PT 100: -20 °C – 220 °C or -4 °F – 428°F

This setting specifies the reference range for the dead band of the process controller as well as for the analogue feedback of the process actual value (option).

** If the sub-menu is left by pressing the selection key on the left (ESC), the value remains unchanged.*

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② PVmax X *X

Upper scaling value for the process actual value

Settings:

The unit for the temperature and the position for the decimal point is transferred from the inputs of the lower scaling value.

1. Input the upper scaling value for the process actual value

Press the down arrow key (←) to highlight the individual positions with a dark background. Press the up arrow key (+) to set the value.

Adjustment range: -200 ... 800

Measurement range of the PT 100: -20 °C – 220 °C or -4 °F – 428°F

This setting specifies the reference range for the dead band of the process controller as well as for the analogue feedback of the process actual value (option).

⑨ *SP INPUT* - Type of set-point value default (internal / external)

This function specifies whether the set-point value default

- internal: is implemented by pressing the keys on the positioner or
- external: is implemented via the unit signal input.

Factory setting: *internal*

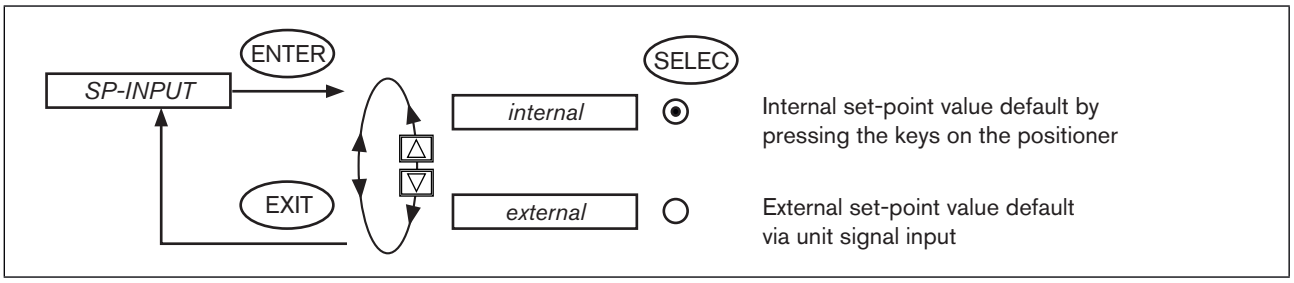

Fig. 13: Operating structure P.CONTROL - SP-INPUT

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⑩ *SP - SCALE* - Scaling of the position controller

This function is indicated in the selection menu only if the external set-point value default *(external)* has been selected in the SP INPUT menu option.

The *SP-SCALE* function assigns the values for the lower and upper process set-point value to the particular current or voltage value of the unit signal.

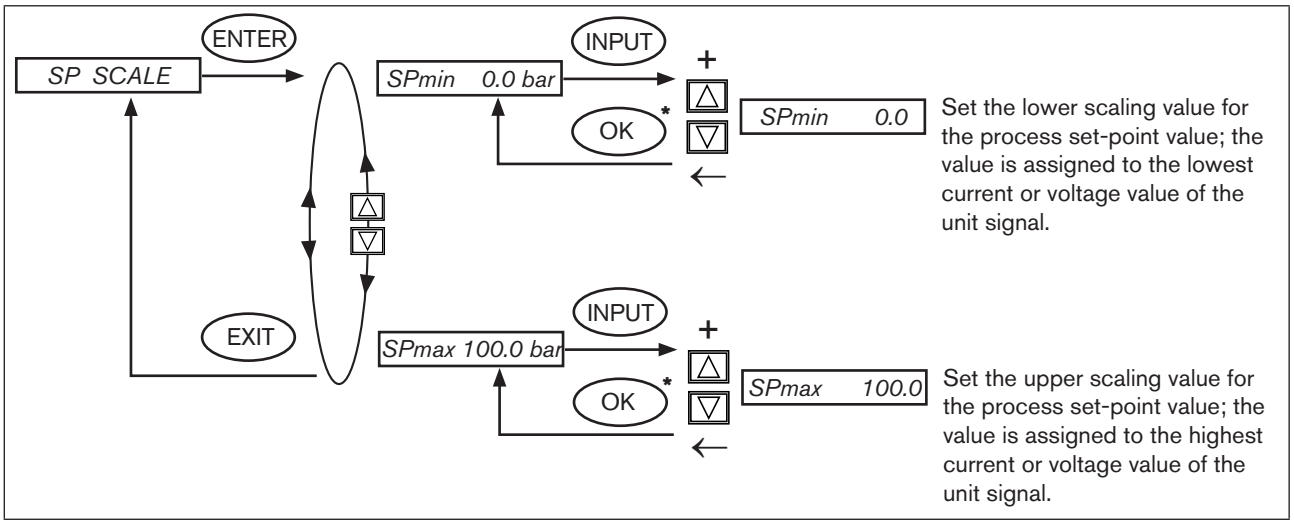

Fig. 14: Operating structure P.CONTROL - SP-SCALE

Procedure for setting the scaling values (in the example of the lower scaling value *SPmin*):

→ Press the right selection key (INPUT) to enter the input screen for *SPmin*.

On the display the last digit of the value is highlighted with a dark background.

→ Press the up arrow key (+) to specify the individual digits of the value and switch to the next digit with the down arrow key (←).

→ When all input values have been specified, confirm by pressing the right selection key (OK) and jump back to the selection screen.

⑪ *P.CO INIT* - Setting the smooth switchover between MANUAL and AUTOMATIC mode

The *P.CO INIT* function enables a smooth switchover between the MANUAL and AUTOMATIC operating states.

Factory setting: *bumpless*

Fig. 15: Operating structure P.CO INIT

** If the sub-menu is left by pressing the selection key on the left (ESC), the value remains unchanged.*

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2.5.5 Linearisation of the process characteristic *P.Q'LIN*

This function automatically linearises the process characteristic of a flow control.

Ⓓ

This function is only meaningful if a flow control is to be implemented.
The *P.Q'LIN* function can only be started if the menu option *P.CONTROL / SETUP / PV-INPUT / frequency* or *P.CONTROL / SETUP / PV-INPUT / 4-20 mA* has been selected.

When the *P.CONTROL* function is activated, the *P.Q'LIN* functions required for process control are copied into the main menu. This function starts the program which automatically determines the nodes for a correction characteristic.

→ Start the routine to linearise the process characteristic by selecting the *P.Q'LIN* menu option in the main menu and press the selection key on the right (RUN) for approx. 3 seconds (countdown).

The program increases the valve stroke in 20 steps from 0 to 100 % and measures the associated process variable. The value pairs of the correction characteristic are placed as a freely programmable characteristic under the *CHARACT / FREE* menu option and can be viewed under this menu option.
If the *CHARACT* menu option under the *ADDFUNCTION* menu option was not transferred into the main menu, the transfer occurs automatically when the *P.Q'LIN* function is implemented. At the same time the *CHARACT / FREE* menu option is activated.

Displays on the panel during selection and implementation of the routine

Display	Description
Q.LIN #0 *CMD=0%* *Q.LIN #1* *CMD=10%* *:* *Q.LIN #10* *CMD=100%*	Display of the node which is just being started (progress is indicated by a bar running along the upper edge of the display)
Q.LIN *ready* or *Q.LIN* *err/break*	Display at the end of the routine Display if an error occurs

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3 OPERATION OF THE PROCESS CONTROLLER

A precise description of the control and display elements, as well as the configuration of the keys can be found in the chapter entitled *"Control and display elements"*.

When the operating voltage has been switched on, the positioner is at the process operating level in the AUTOMATIC operating state.

At the process operating level the normal control mode is implemented and monitored (AUTOMATIC) and the valve is manually opened or closed (MANUAL).

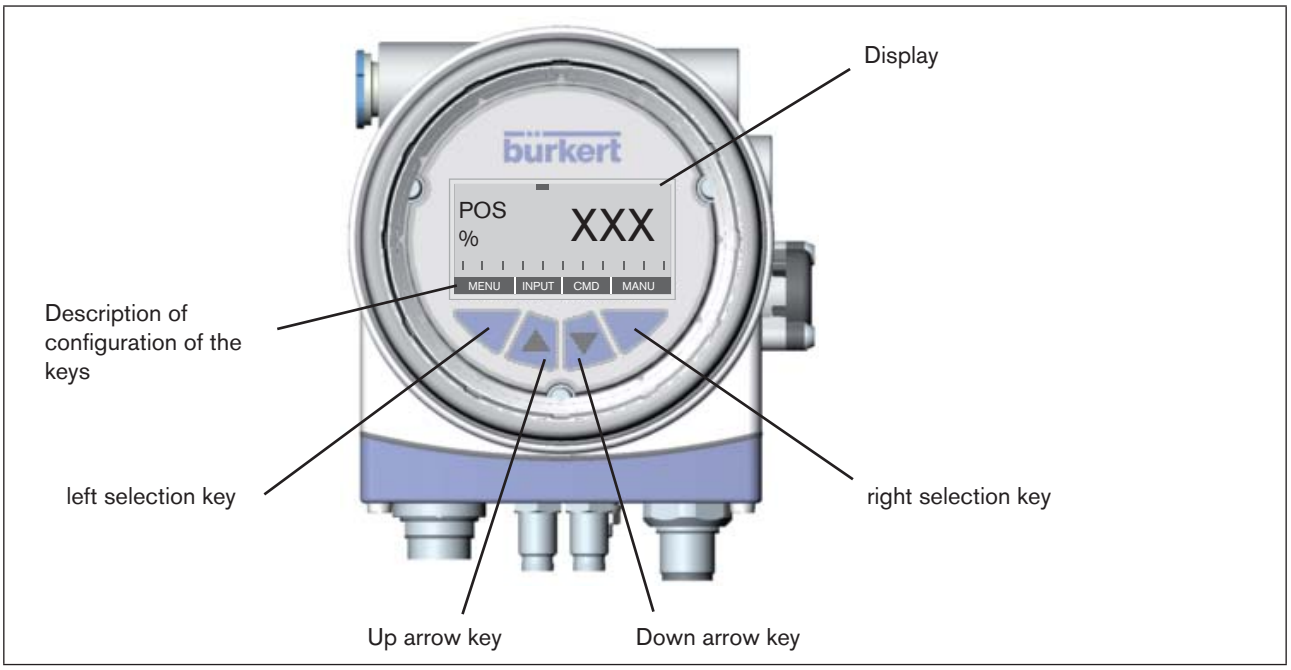

Fig. 16: Description of the control module

3.1 Switching between the Operating States

The right Selection key can be used to switch between the two operating states AUTOMATIC (AUTO) and MANUAL (MANU).

In the AUTOMATIC operating state a bar runs along the upper edge of the display from left to right.

3.2 Switching between the Operating Levels

Process operating level -> Configuration level

Both in the MANUAL and AUTOMATIC operating state you switch to the configuration level by pressing the left selection key (MENU) for approx. 3 seconds. During these 3 seconds 2 bars converge on the display (Countdown).

At the Configuration level the operating parameters can be input or changed, auxiliary functions supplemented or the automatic adjustment (*X.TUNE*) of the controller started.

A precise description of the individual functions can be found in the chapters entitled *"Start-up, operation of the position controller Type 8692" - "Specifying the basic settings"* and in *"Configuring the auxiliary functions"*.

Configuration level -> Process operating level

Press the left selection key (EXIT) to switch from the Configuration level to the Process operating level. In doing so, the operating state which was selected before the switchover (AUTOMATIC or MANUAL) is set.

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3.3 AUTOMATIC operating state

Bar running from left to right along the upper edge of the display.
Normal control mode is implemented and monitored in AUTOMATIC operating state.

3.3.1 Meaning of the keys

key	Configuration*	Description
Left selection key	MENU	Switch to the Configuration level (press for approx. 3 s)
Right selection key	MANU	Switch between the AUTOMATIC (AUTO) or MANUAL (MANU) operating modes
Up arrow key 	SP POS CMD TEMP PV	Switch between the displays
Down arrow key 	CMD TEMP PV SP POS	

3.3.2 Information on the Display

The following variables are indicated on the display for the process controller and it is possible to switch between them with the arrow keys:

Representation of value*	Value range / unit	Description
POS XXX	0...100 %	Display of actual position of the valve actuator
CMD XXX	0...100 %	Display of nominal position of the valve actuator
TEMP XXX	-100 – 150 °C	Internal temperature in the housing of the positioner
PV XXX	Depending on the signal type	Process actual value
SP XXX	Depending on the signal type	Process set-point value

* *Displayed only when P.CONTROL auxiliary function activated*

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3.3.3 Operating Structure

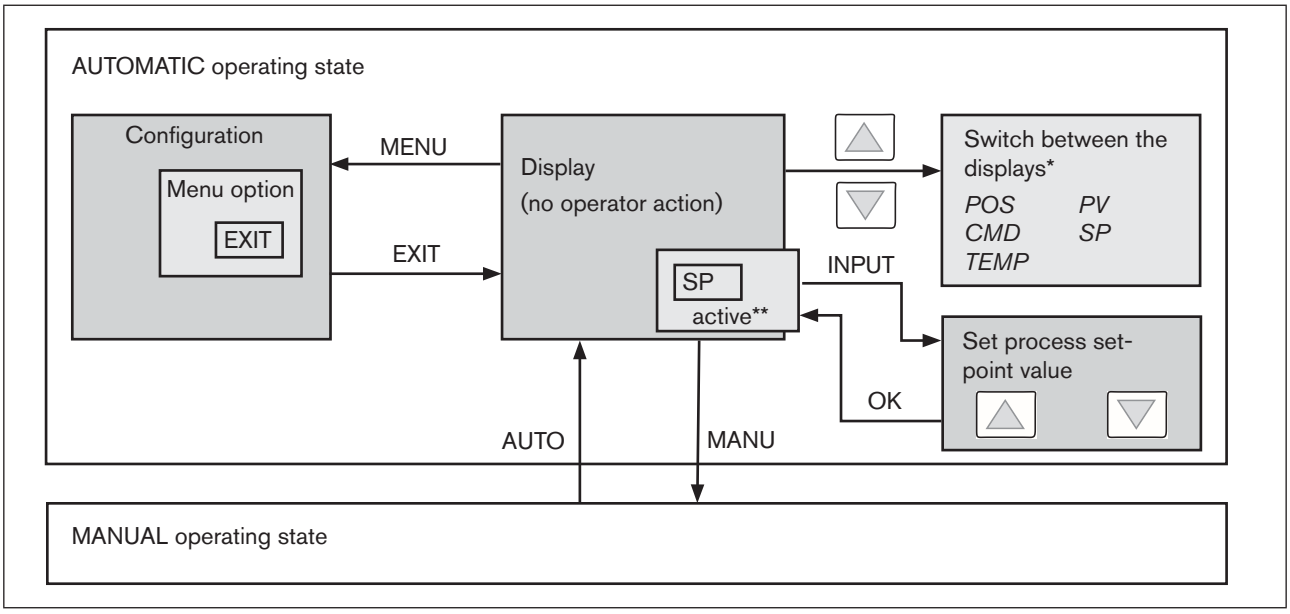

Fig. 17: AUTOMATIC operating structure - 8693

3.3.4 Manually Changing the Process set-point value

If the auxiliary function *P.CONTROL / SETUP / SP INPUT / internal* (set the set-point value via keys) is specified during the configuration, the menu to change the process set-point value can be activated when the *SP* (Setpoint) display is set by pressing the right selection key (INPUT). The individual digits can be set by pressing the arrow keys. Press the right selection key (OK) to accept the set value.

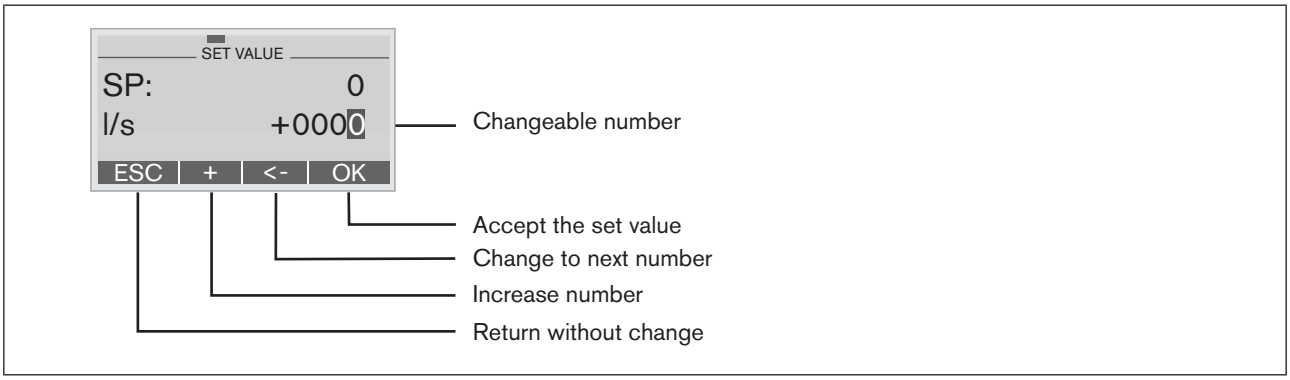

Fig. 18: Setting numerical values SP

* *Displayed only when P.CONTROL auxiliary function activated.*

** *only active if the internal set-point value default (P.CONTROL / SETUP / SP INPUT / internal) has been selected.*

3.4 MANUAL operating state

Without bar running from left to right along the upper edge of the display.
In MANUAL operating state the valve can be opened or closed manually.

3.4.1 Meaning of the keys

key	Configuration	Description
Left selection key	MENU	Switch to the Configuration level (press for approx. 3 s)
Right selection key	MANU	Switch between the AUTOMATIC (AUTO) or MANUAL (MANU) operating modes
Up arrow key	OPN CLS*	Aerate the actuator Control function A (SFA): Valve opens Control function B (SFB): Valve closes Control function I (SFI): Connection 2.1 aerated
Down arrow key	CLS OPN*	Deaerate the actuator Control function A (SFA): Valve closes Control function B (SFB): Valve opens Control function I (SFI): Connection 2.2 aerated

SFA: Actuator closes by spring force
SFB: Actuator opens by spring force
SFI: Actuator double-acting

3.4.2 Information on the Display

After switching to the MANUAL operating state, the display automatically jumps to the actual position (*POS*) of the valve actuator.

3.4.3 Operating structure

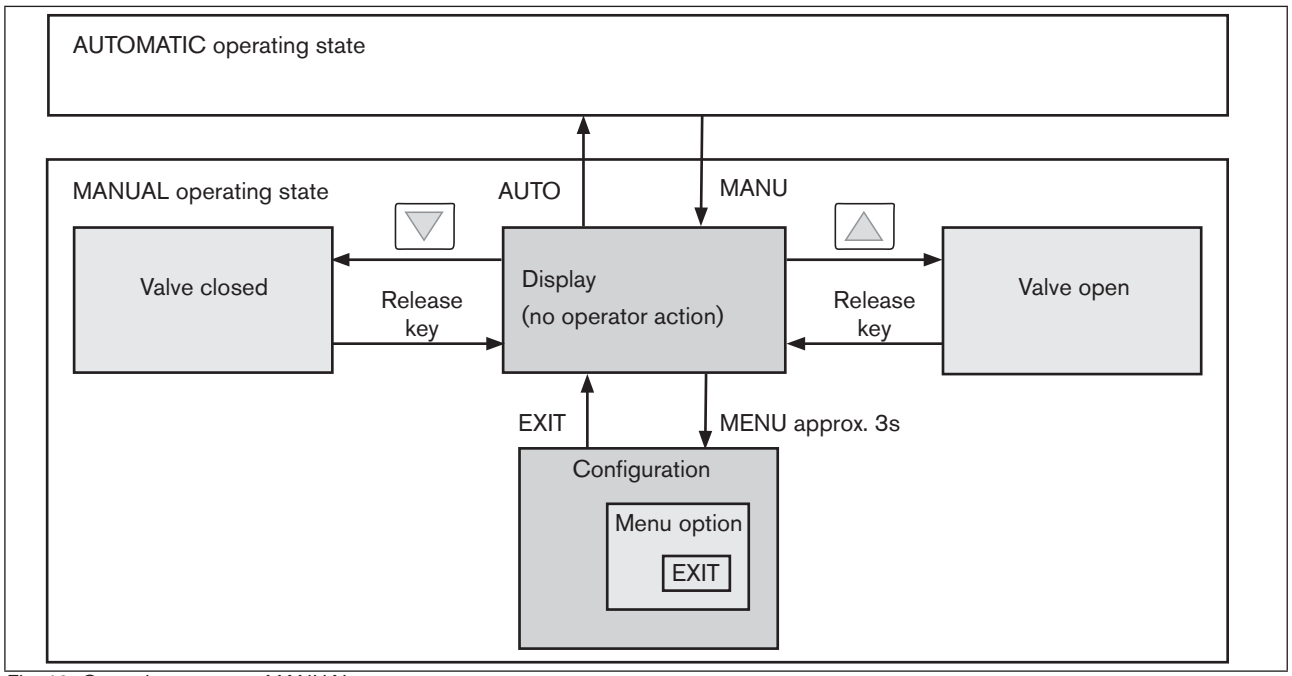

Fig. 19: Operating structure MANUAL

* *only if "Fall" is set in the DIR.ACT auxiliary function*

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4 AUXILIARY FUNCTIONS FOR THE PROCESS CONTROLLER

In this chapter only those auxiliary functions are described which differ from the position controller Type 8692. All other auxiliary functions and their settings can be found in the chapters entitled *"Start-up, operation of the position controller Type 8692" - "Configuring the auxiliary functions"*.

4.1 Overview of the auxiliary functions

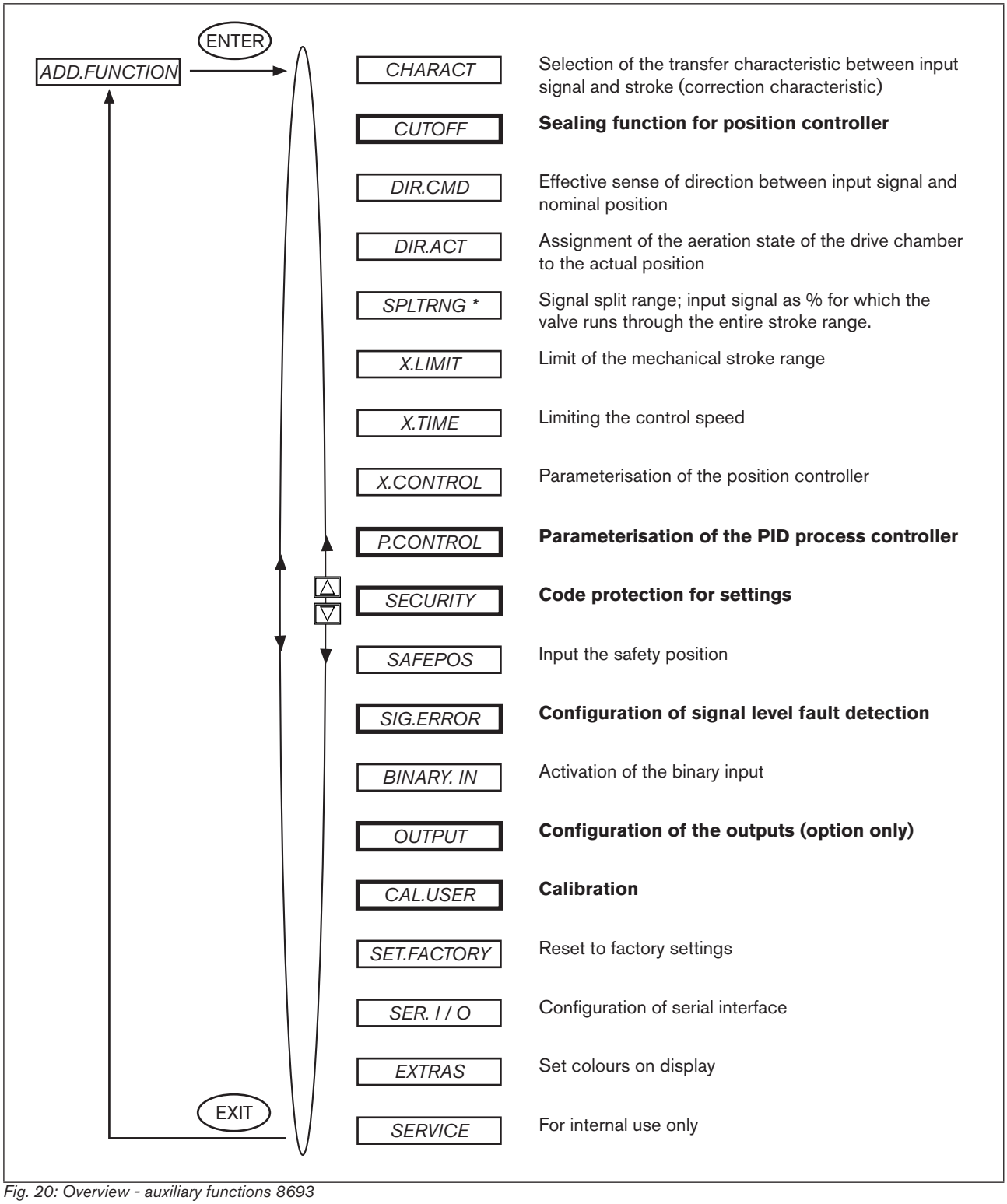

Fig. 20: Overview - auxiliary functions 8693

* *SPLTRNG auxiliary function can only be selected if P.CONTROL auxiliary function is inactive.*

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If the *P.CONTROL* auxiliary function is active for the process controller Type 8693, the following auxiliary functions differ from those described for the position controller Type 8692 (highlighted in Fig. 20):

- *CUTOFF*
- *SECURITY*
- *SIG.ERROR*
- *OUTPUT*
- *CAL. USER*

4.1.1 Including auxiliary functions in the main menu

→ Press the arrow keys to select the *ADD.FUNCTION* menu option in the main menu and press the right selection key (ENTER) to enter the submenu.
→ Press the arrow keys to select the required auxiliary function.
→ Press the selection key on the right (ENTER) to mark the auxiliary function with a cross (x).
→ All marked functions are transferred to the main menu when the selection key on the left (EXIT) is pressed.
→ In the main menu input the parameters of the auxiliary functions.

4.1.2 Removing auxiliary functions from the main menu

If a function is removed from the main menu, the settings implemented previously under this function become invalid again.

→ Press the arrow keys to select the *ADD.FUNCTION* menu option in the main menu.
→ Enter the submenu by pressing the selection key on the right (ENTER).
→ Press the arrow keys to select an auxiliary function indicated with a cross (x).
→ Press the selection key on the right (ENTER) to remove the cross (x).
→ After pressing the selection key on the left (EXIT), the auxiliary function is deactivated and removed from the main menu.

A precise description on the operation of the auxiliary functions can be found in the chapters entitled *"Start-up, operation of the position controller Type 8692" - "Specifying the basic settings"* and in *"Configuring the auxiliary functions"*.

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4.2 *CUTOFF*
Sealing function for the position controller Type 8693

This function causes the valve to be sealed outside the control area.

This is where you input the limits for the position set-point value (*CMD*) as a percentage or for the process set-point value (*SP*) as a percentage of the scaling range, from which the actuator is fully deaerated or aerated. Control mode opens or resumes at a hysteresis of 1 %. If the process valve is in the sealing area, the message *"CUTOFF ACTIVE"* is indicated on the display.

Factory setting: *Min= 0 %; Max = 100 %; CUT type = Type PCO*

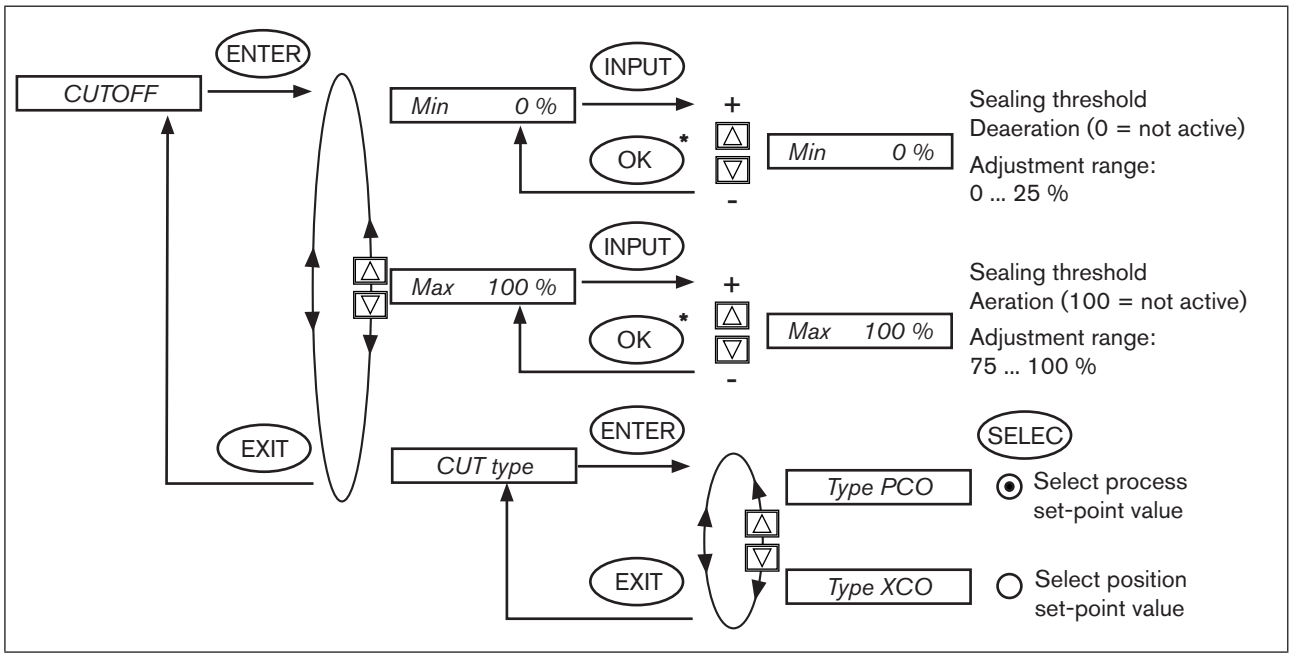

Fig. 21: Operating structure CUTOFF-8693

Changed values are not transferred into the memory (EEPROM) until the main menu (MAIN) is left.

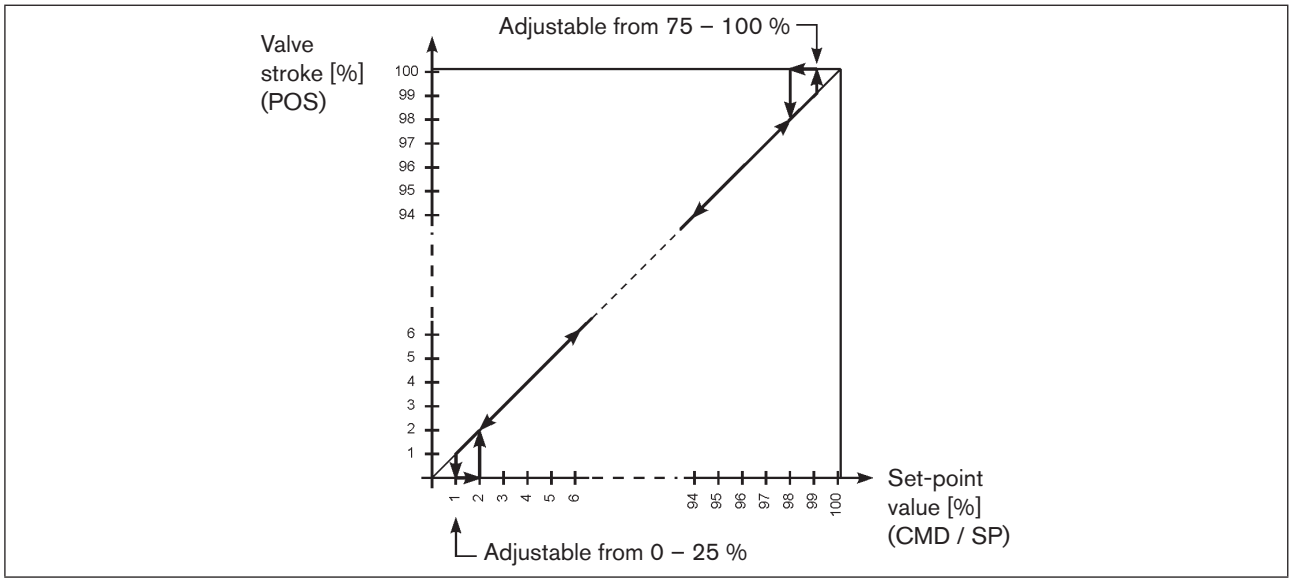

Fig. 22: Graph - CUTOFF - 8693

** If the sub-menu is left by pressing the selection key on the left (ESC), the value remains unchanged.*

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4.3 *SECURITY*
Code protection for the settings

Use the *SECURITY* function to prevent the positioner or individual functions from being accessed unintentionally.

Factory setting: *Access Code:* *0000*

If the code protection is activated, the code (set access code or master code) must be input whenever operator action is disabled.

All operator actions can be implemented with the non-changeable master code. This 4-digit master code can be found in the appendix of these operating instructions in the chapter entitled *"Master code"*.

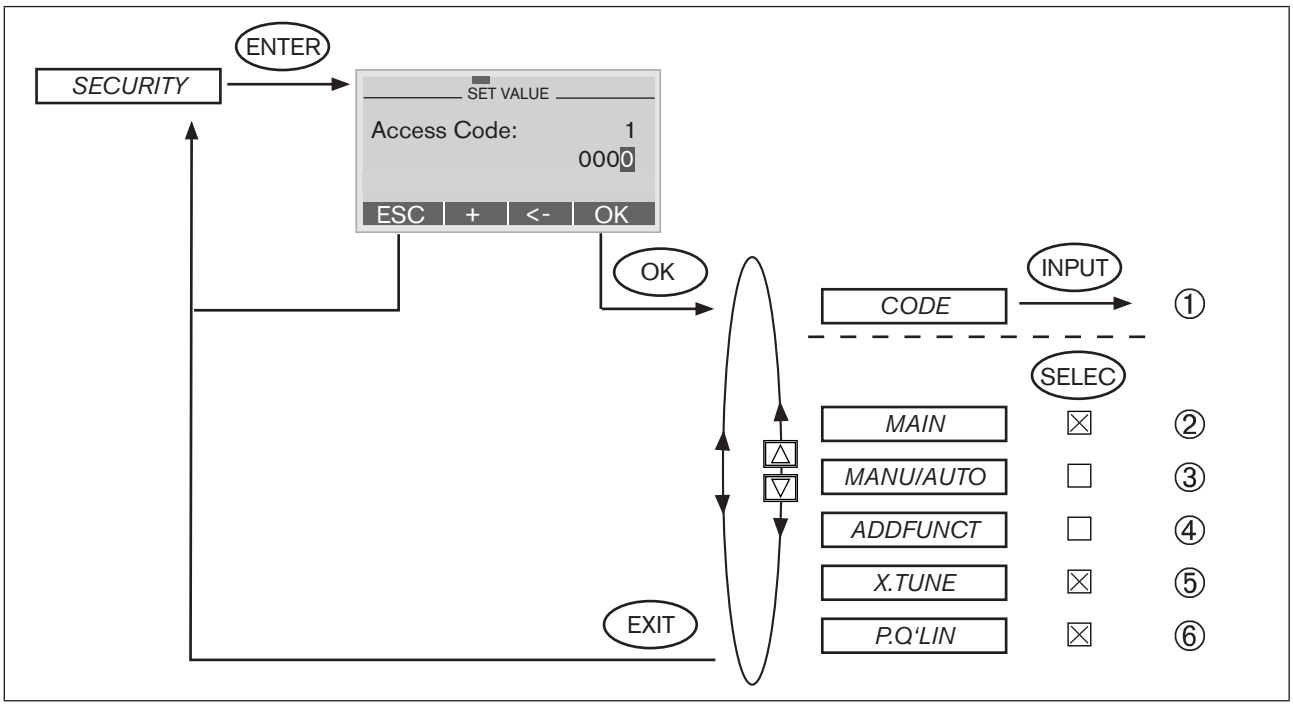


Fig. 23: Operating structure SECURITY - 8693

① Input screen for inputting or changing the *CODE* (for description of input see below)

② Blocking access to the configuration level

③ Blocking switchover between the MANUAL / AUTOMATIC (MANU/AUTO) operating states

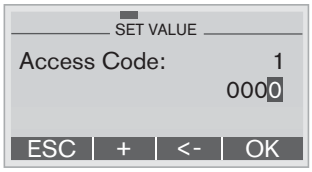
④ Blocking the input of auxiliary functions

⑤ Blocking the activation of self-parameterisation (Autotune)

⑥ Blocking the activation of the linearisation of the process characteristic

Inputting the code:

→ Press the selection key on the right (INPUT) to access the input screen when the *CODE* selection menu is marked.



The code consists of four digits which can be changed individually by pressing the up arrow key (+).

Press the down arrow key (←) to jump between the individual digits.

Press the selection key on the left (ESC) to leave the input screen without change.

Press the selection key on the right (OK) to leave the input screen and save the input or change.

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4.4 *SIG-ERROR*
Configuration of signal level fault detection

The *SIG-ERROR* function is used to detect a fault on the input signal.

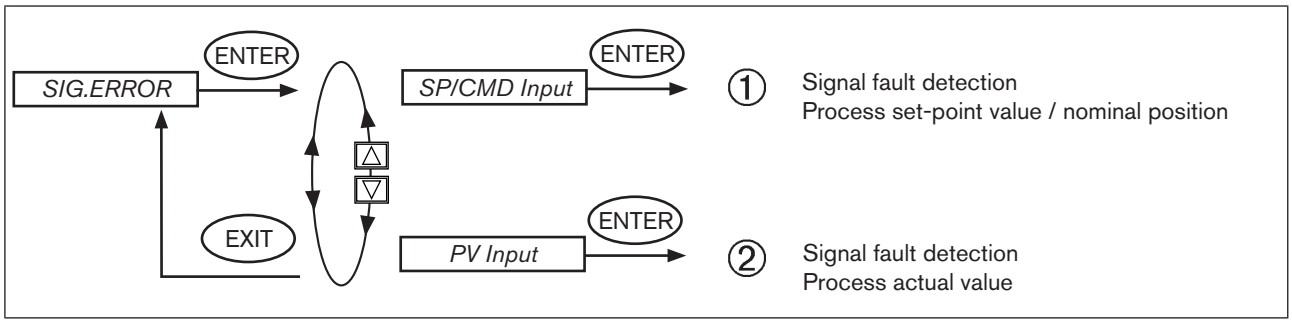

Fig. 24: Operating structure SIG-ERROR-8693

The operating structure of the menu options *SP/CMD Input* and *PV Input* is identical and is described in the diagram below:

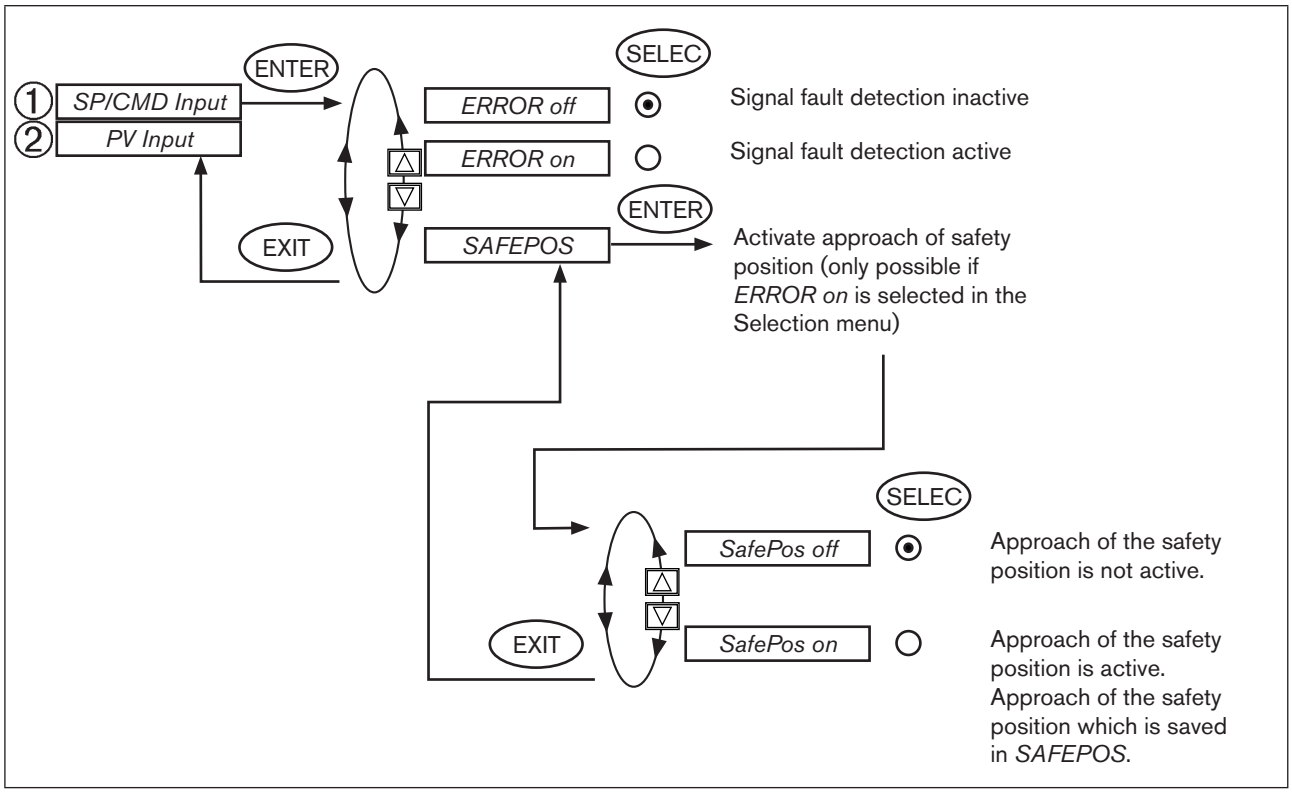

Fig. 25: Operating structure SIG-ERROR-8693-SP-CMD-PV

If signal fault detection is activated, the respective fault is indicated on the display.
(see chapter entitled "*Maintenance and troubleshooting*")

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Fault detection
Fault detection can be selected at 4 – 20 mA and with a PT100 signal.
4 – 20 mA
Fault with input signal ≤ 3.5 mA (± 0.5 % of end value, hysteresis 0.5 % of end value)
PT100
Fault with input signal 225 °C (± 0.5 % of end value, hysteresis 0.5 % of end value)

If other signal types are selected or if process controllers are not activated, the respective menu branch is hidden. If this configuration does not allow either of the two fault detections, *not available* is indicated in the selection menu.

Safety position *SAFEPOS on*

When *SAFEPOS on* is set, the following configurations may occur:

Active *SAFEPOS*
menu option If a fault is detected, the actuator moves to the lower *SAFEPOS* set position.

Inactive *SAFEPOS*
menu option If a fault is detected, the actuator moves to the end position which it would specify in the isolated state.

4.5 *OUTPUT* (option) Configuring the outputs

The *OUTPUT* menu option is only indicated in the selection menu of *ADD.FUNCTION* if the positioner has outputs (option).

The outputs can be used for the following feedback signals:

Analogue output:	Feedback of the current position (*POS*), the position set-point value (*CMD*), the process actual value (*PV*) or the process set-point value (*SP*) to the control centre.
Binary outputs:	Alarm output for excessively large control deviations of the position controller or
	for the output of the current position with respect to a specified limit position (> or <) or
	for the output: actuator in safety position or
	for the output of a sensor break or
	for the output: operating state AUTOMATIC / MANUAL.

The positioner which has the outputs option is available in the following versions:

- one analogue output
- one analogue and two binary outputs
- two binary outputs

According to the version of the positioner only the possible adjustable outputs (*ANALOGUE, ANALOGUE + BIN 1 + BIN 2 or BIN 1 + BIN 2*) are indicated in the OUTPUT menu option.

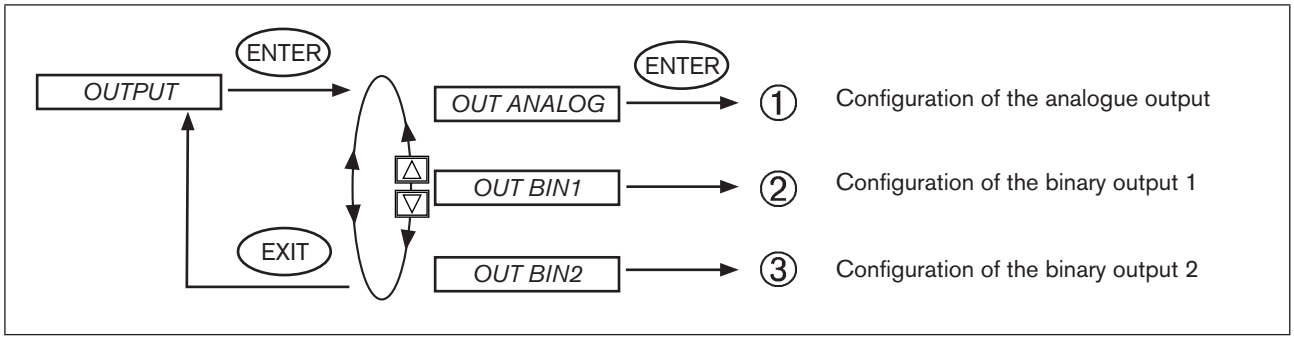

Fig. 26: Operating structure OUTPUT

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① *OUT ANALOG* - Configuration of the analogue output

Only for the versions:
- one analogue output
- one analogue output and two binary outputs

The feedback of the current position (*POS*), the position set-point value (*CMD*), the process actual value (*PV*) or the process set-point value (*SP*) can be transmitted to the control centre via the analogue output.

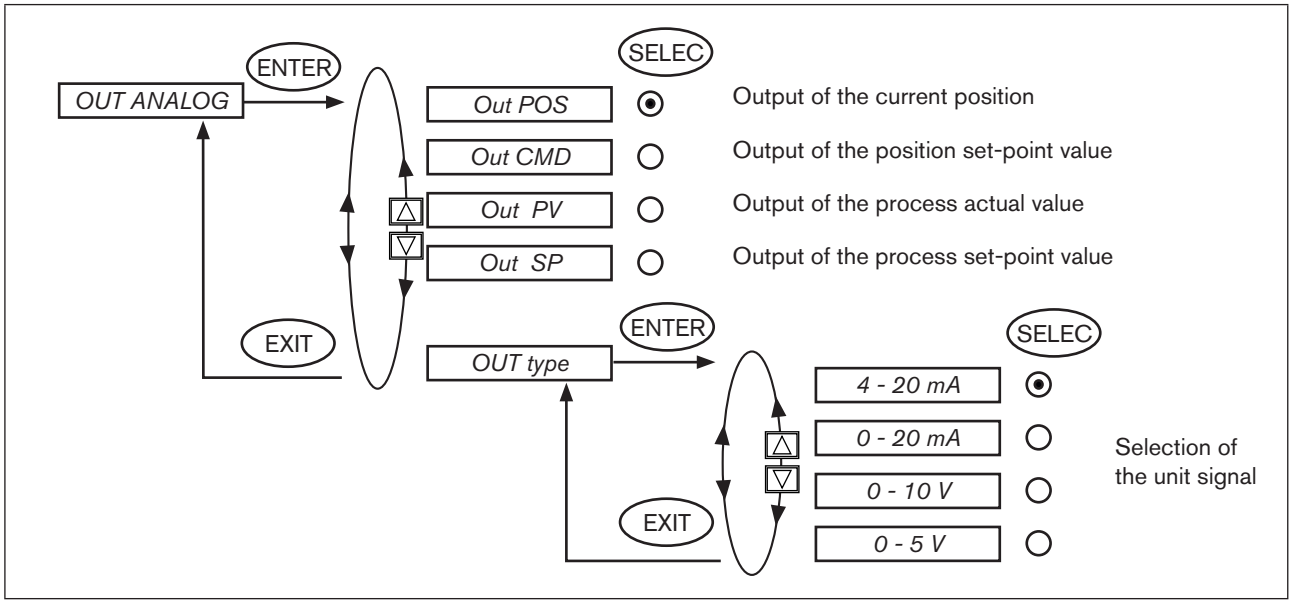

Fig. 27: Operating structure OUTPUT-ANALOGUE-8693

Changed values are not transferred into the memory (EEPROM) until the main menu (MAIN) is left.

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② ***OUT BIN1*** **- Configuration of the binary output 1**

③ ***OUT BIN2*** **- Configuration of the binary output 2**

Only for the versions:
- one analogue output and two binary outputs
- two binary outputs

The following description applies to both binary outputs *OUT BIN 1* and *OUT BIN 2*.

The binary outputs 1 and 2 can be used for one of the following outputs:
- Alarm output for excessively large control deviations of the position controller
- for the output of the current position with respect to a specified limit position (> or <)
- for the output: actuator in safety position
- for the output: sensor break process set-point value ***
- for the output: sensor break process actual value ***
- for the output: operating state MANUAL / AUTOMATIC.

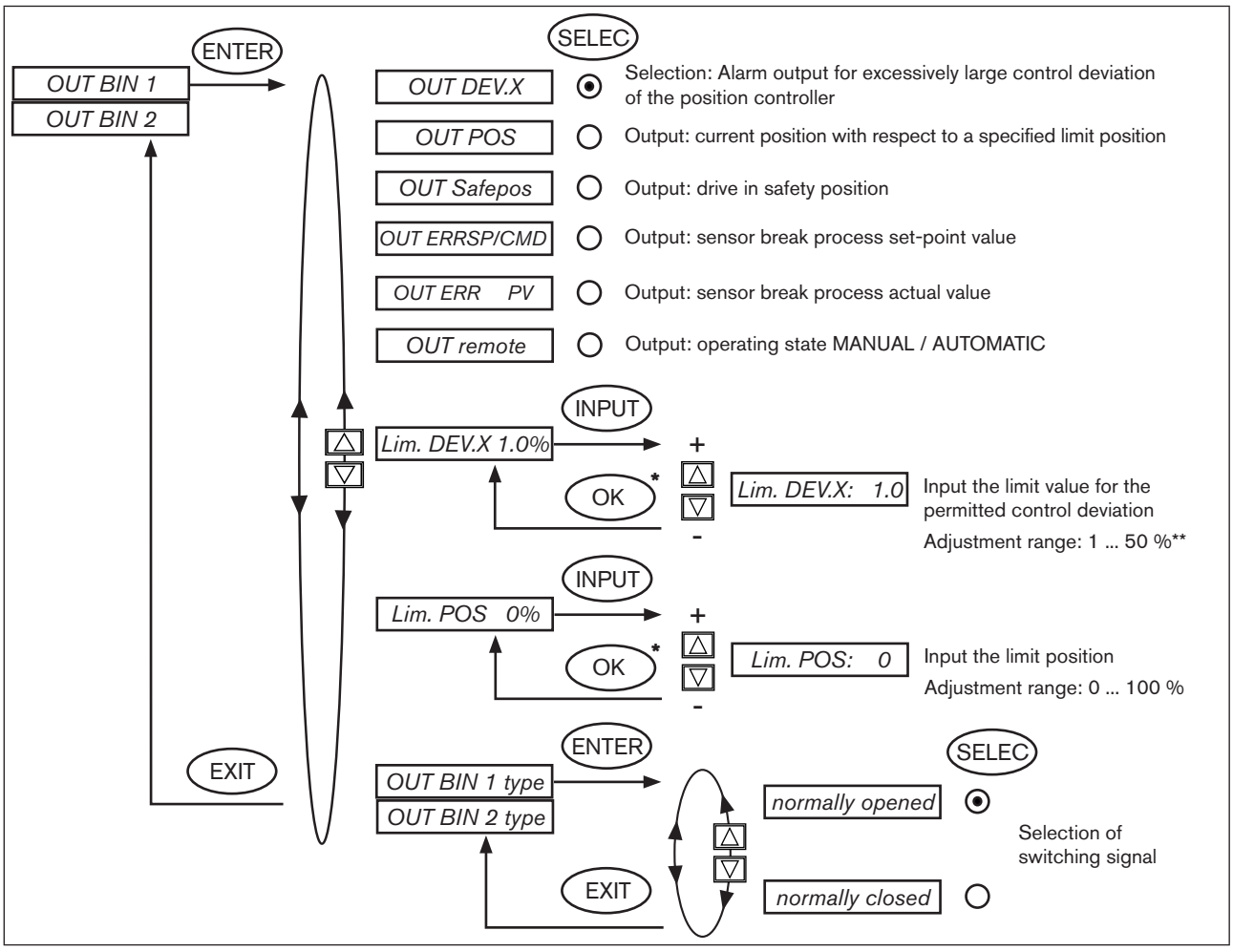

Fig. 28: Operating structure OUTPUT-BIN1-8693

Normally closed output, in switched state *low* (≙ 0 V)
Normally opened output, in switched state *high* (≙ 24 V)

* *If the sub-menu is left by pressing the selection key on the left (ESC), the value remains unchanged.*

** *The permitted control deviation Lim DEV.X XX must not be less than the dead band.*

*** *only possible if signal level fault detection activated (see chapter entitled "SIG-ERROR")*

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Alarm output for excessively large control deviation of the position controller: *OUT DEV.X*

→ Press the arrow keys to mark the *OUT DEV.X* menu option and confirm with the selection key on the right (SELEC).

→ Press the arrow keys to input the limit value for the permitted control deviation in the Lim. DEV.X 1.0% menu option and accept with the selection key on the right (OK).

The permitted control deviation *Lim. DEV.X XX* must not be less than the dead band.

→ In the *OUT BIN type* menu option input the required switching status (*normally opened* / *normally closed*)*.

Output of the current position with respect to a specified limit position: *OUT POS*

→ Press the arrow keys to mark the *OUT POS* menu option and confirm with the selection key on the right (SELEC).

→ Press the arrow keys to input the the value of the limit position in the Lim. POS 0% menu option and accept with the selection key on the right (OK).

→ In the *OUT BIN type* menu option input the required switching status (*normally opened* / *normally closed*).

OUT BIN1	*normally opened*	*normally closed*
POS > LIM	0 V	24 V
POS < LIM	24 V	0 V

Output of message: Actuator in safety position: *OUT Safepos*

→ Press the arrow keys to mark the *OUT Safepos* menu option and confirm with the selection key on the right (SELEC).

→ In the *OUT BIN type* menu option input the required switching status (*normally opened* / *normally closed*).

Output sensor break: *OUT ERR SP/CMD**

→ Press the arrow keys to mark the *OUT ERR SP/CMD* menu option and confirm with the selection key on the right (SELEC).

→ In the *OUT BIN type* menu option input the required switching status (*normally opened* / *normally closed*).

Output sensor break: *OUT ERR PV**

→ Press the arrow keys to mark the *OUT ERR PV* menu option and confirm with the selection key on the right (SELEC).

→ In the *OUT BIN type* menu option input the required switching status (*normally opened* / *normally closed*).

Output operating state AUTOMATIC / MANUAL: *OUT remote*

→ Press the arrow keys to mark the *OUT remote* menu option and confirm with the selection key on the right (SELEC).

→ In the *OUT BIN type* menu option input the required switching status (*normally opened* / *normally closed*).

OUT BIN1	*normally opened*	*normally closed*
AUTOMATIC operating state	0 V	24 V
MANUAL operating state	24 V	0 V

Normally closed output, in switched state *low* (≙ 0 V)
Normally opened output, in switched state *high* (≙ 24 V)

* *only possible if signal level fault detection activated (see chapter entitled "SIG-ERROR")*

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4.6 *CAL.USER*
Calibrating the actual value display and the inputs for the process values

The following points can be manually calibrated with this function:

- Position display (*POS*) 0 – 100%
- Process set-point value display (*SP*)***
- Process actual value display (*PV*)

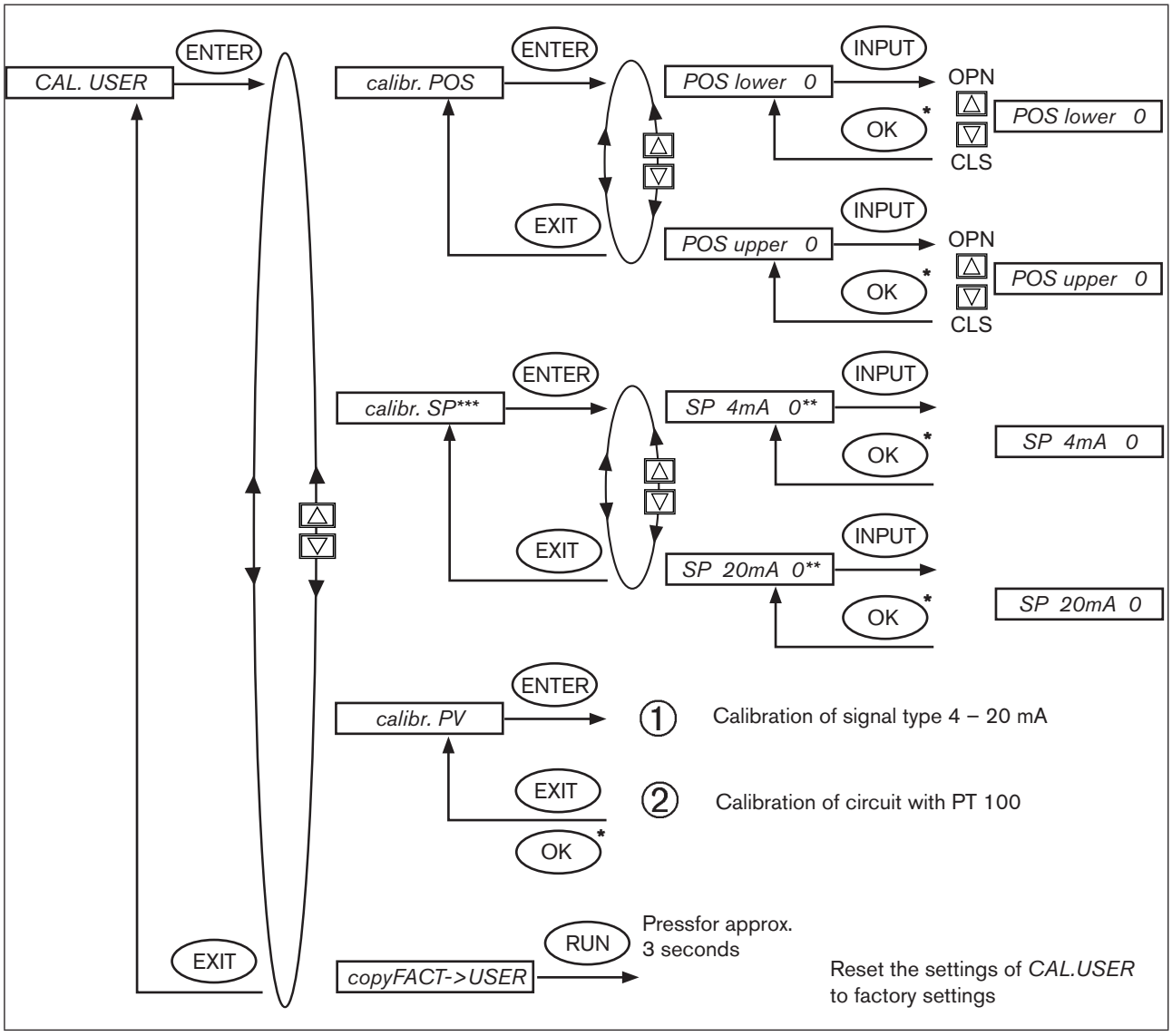

Fig. 29: Operating structure CAL.USER-8693

Remove the *CAL.USER* auxiliary function to re-activate the factory calibration.

* *If the sub-menu is left by pressing the selection key on the left (ESC), the value remains unchanged.*

** *The signal type is displayed which is selected in the INPUT menu (4 – 20 mA; 0 – 20 mA; 0 – 5 V; 0 – 10 V).*

***Only if external set-point value default is set in the P.CONTROL / SETUP / SP-INPUT*

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Procedure:

Calibrating the actual value display *POS* (0 - 100 %): *calibr. POS*

→ In the *CAL. USER* menu press the arrow keys to select the *calibr. POS* menu option and confirm with the selection key on the right (ENTER).

Accept the minimum position:

→ Press the arrow keys to select the *POS lower X* menu option and confirm with the selection key on the right (INPUT).

→ Approach the minimum position of the valve using the arrow keys (OPN/CLS) and confirm this value by pressing the selection key on the right (OK).

Accept the maximum position:

→ Press the arrow keys to select the *POS upper X* menu option and confirm with the selection key on the right (INPUT).

→ Approach the maximum position of the valve using the arrow keys (OPN/CLS) and confirm this value by pressing the selection key on the right (OK).

Calibrating the process set-point value (4 – 20 mA; 0 – 20 mA; 0 – 5 V; 0 – 10 V): *calibr. SP**

→ In the *CAL. USER* menu press the arrow keys to select the *calibr. SP* menu option and confirm with the selection key on the right (ENTER).

Accept the minimum input signal (0 mA; 4 mA; 0 V)**:

→ Press the arrow keys to select the *SP (0 mA; 4 mA; 0 V)* menu option and confirm with the selection key on the right (INPUT).

→ Apply the minimum value of the unit signal on the input and confirm by pressing the selection key on the right (OK).

Accept the maximum input signal (20 mA; 5 V; 10 V)**:

→ Press the arrow keys to select the SP (20 mA; 5 V; 10 V) menu option and confirm with the selection key on the right (INPUT).

→ Apply the maximum value of the unit signal on the input and confirm by pressing the selection key on the right (OK).

Calibrating the process actual value (4 – 20 mA or PT 100): *calibr. PV*

① **4 – 20 mA:**

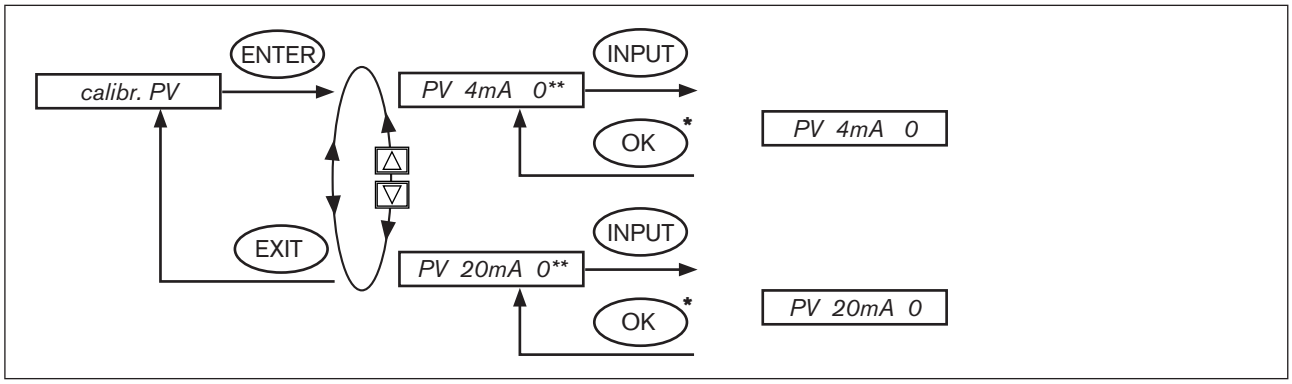

Fig. 30: Operating structure CAL.USER-8693-PV-4-20

→ In the *CAL. USER* menu press the arrow keys to select the *calibr. PV* menu option and confirm with the selection key on the right (ENTER).

Accept the minimum input signal (4 mA):

→ Press the arrow keys to select the *PV 4 mA* menu option and confirm with the selection key on the right (INPUT).

→ Apply the minimum value of the unit signal on the input and confirm by pressing the selection key on the right (OK).

* *If the sub-menu is left by pressing the selection key on the left (ESC), the value remains unchanged.*
** *The signal type is displayed which is selected in the INPUT menu (4 – 20 mA; 0 – 20 mA; 0 – 5 V; 0 – 10 V).*
*** *Only if external set-point value default is set in the P.CONTROL / SETUP / SP-INPUT*

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Accept the maximum input signal (20 mA):

→ Press the arrow keys to select the *PV 20 mA* menu option and confirm with the selection key on the right (INPUT).

→ Apply the maximum value of the unit signal on the input and confirm by pressing the selection key on the right (OK).

② **PT 100:**

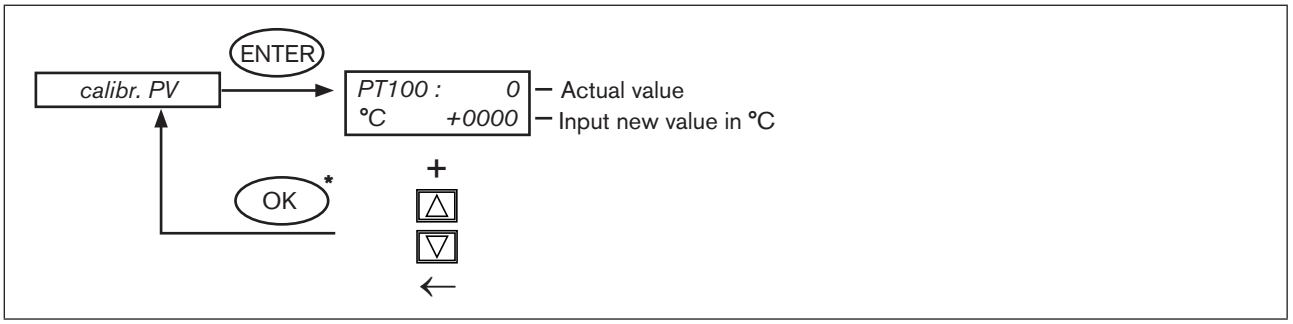

Fig. 31: Operating structure CAL.USER-8693-PV-PT100

An offset value calculated from the actual value and the new value is added to all calculated values.

→ Press the right selection key (INPUT) to enter the input screen for *PT 100*.

On the display the last digit of the new value is highlighted with a dark background.

→ Press the up arrow key (+) to specify the individual digits of the value and switch to the next digit with the down arrow key (←).

→ When all input values have been specified, confirm by pressing the right selection key (OK) and jump back to the selection screen.

Resetting the settings under *CAL.USER* to the factory settings: *copy FACT→USER*

→ In the *CAL. USER* menu press the arrow keys to select the *copy FACT→USER* menu option and confirm with the selection key on the right (ENTER).

→ Hold down the selection key on the right (RUN) (for approx. 3 seconds) until the countdown has elapsed.

* *If the sub-menu is left by pressing the selection key on the left (ESC), the value remains unchanged.*

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PROFIBUS-DP

Table of Contents

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1 GENERAL INFORMATION

The following sections of the general operating instructions do not apply to the positioner with PROFIBUS-DP:

- Variants of the positioner
- Initial start-up
- Electrical connection
- Specifying the standard settings
  - Function *INPUT*
  - Function *SPLTRNG*
  - Function *BINARY-IN*
  - Function *OUTPUT*
  - Function *CAL.USER / calibr. INP*
  - Function *CAL.USER / calibr. SP*

2 TECHNICAL DATA

The protocol sequence complies with the standard DIN 19245 Part 3.

GSD file	BUE2C630.GSD
Bitmap files	BUE2C630.BMP
PNO-ID	C630 Hex
Baudrate	max. 12 Mbaud (is set automatically by the positioner)
Sync and Freeze modes	are not supported
Diagnosis telegram	No device-specific diagnosis
Parameter telegram	No user parameters

The process data is configured in the positioner and in the PROFIBUS master.
Maximum 10 process values (total *INPUT* and *OUTPUT*) can be transferred.

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3 SAFETY SETTINGS IF THE BUS FAILS

The position is approached which corresponds to the set-point value last transferred (default setting).

Other setting optioins (see chapter entitled *Settings on the positioner*).

4 INTERFACES

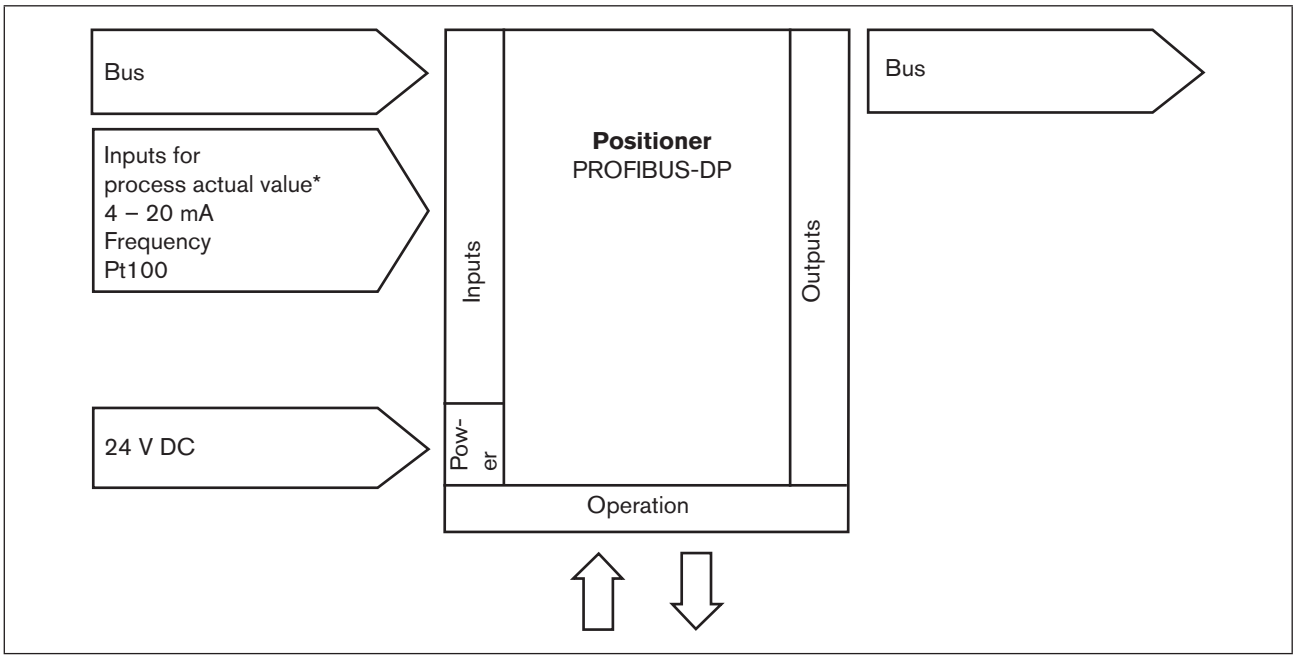

Fig. 1: Interfaces PROFIBUS-DP

* *only for process controller Type 8693*

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5 ELECTRICAL CONNECTIONS

DANGER!

Danger - electrical voltage in the equipment!

There is a serious risk of injury when reaching into the equipment.

- Before starting work, always switch off the power supply and safeguard to prevent re-activation!

WARNING!

Danger - improper installation!

Improper installation may result in injuries as well as damage to the device and the area around it.

- Fluid and electrical installations may be carried out by authorised technicians only and with the appropriate tools!

Danger due to unintentional activation of the equipment!

Unintentional activation of the equipment during installation may result in injuries and damage.

- Take appropriate measures to prevent the equipment from being unintentionally activated.

→ For operation of the device always connect the 5-pole, inversely coded M12 round socket and the 4-pole M12 round plug (power supply).

The connection module of Type 8692 and 8693 features a setscrew with nut which is used to connect the Technical Earth (see diagram).

→ Connect the setscrew to a suitable earthing point.
To ensure electromagnetic compatibility (EMC), ensure that the cable is as short as possible (max. 30 cm, Ø 1.5 mm²).

5.1 Connection Diagram Type 8692

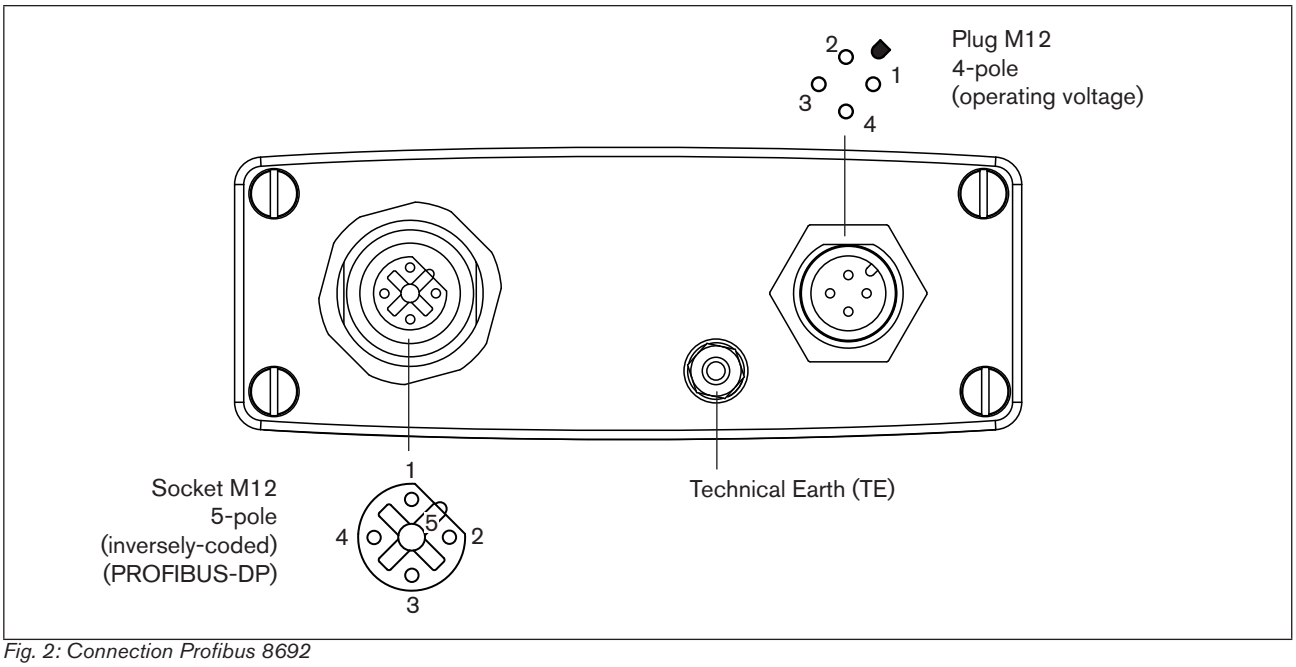

Fig. 2: Connection Profibus 8692

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5.2 Connection Diagram Type 8693

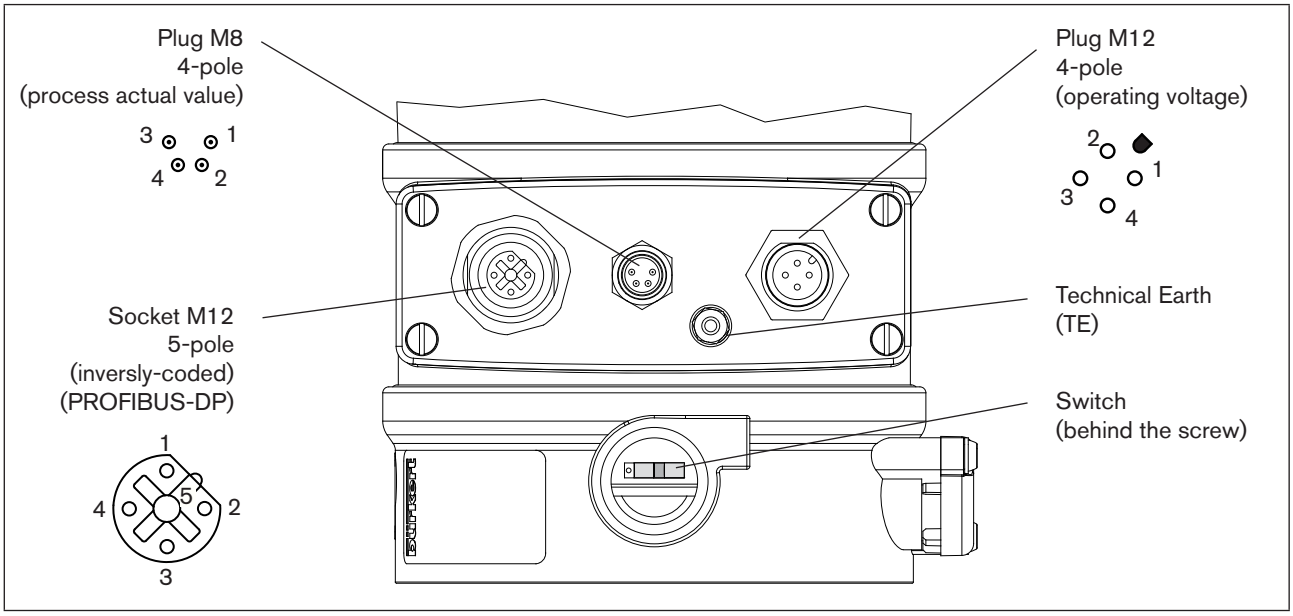
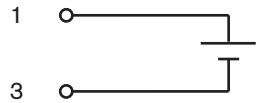


Fig. 3: Connection Profibus 8693

5.3 Operating Voltage (Round Plug M12, 4-pole)

PIN	Configuration	External circuit
1	+ 24 V	 24 V DC ± 10 % max. residual ripple 10 %
2	not used	
3	GND	
4	not used	

5.4 Bus Connection (Round Socket/Plug M12, 5-pole)

PIN	Signal	External circuit
1	VP+5	Supply the terminating resistors
2	RxD/TxD-N	Received/transmitted data -N, A-line
3	DGND	Data transmission potential (earth to 5 V)
4	RxD/TxD-P	Received/transmitted data -P, B-line
5	Shielding	Shielding / protective earth

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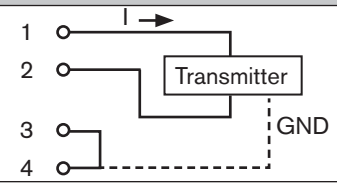
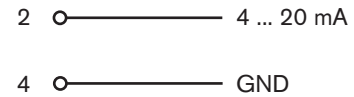
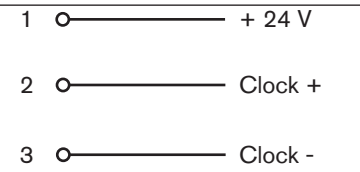
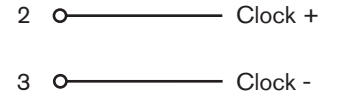
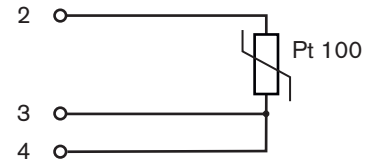
5.5 Process Actual Value (Round Plug M 8) - only Type 8693

Input type*	Pin	Configuration	Switch**	External circuit
4 – 20 mA - internally supplied	1 2 3 4	+ 24 V transmitter supply Output from transmitter GND Bridge after GND (GND from 3-wire transmitter)	Switch on left	
4 – 20 mA - externally supplied	1 2 3 4	not assigned Process actual + not assigned Process actual -	Switch on right	
Frequency - internally supplied	1 2 3 4	+ 24 V sensor supply Clock input + Clock input - (GND) not assigned	Switch on left	
Frequency - externally supplied	1 2 3 4	not assigned Clock input + Clock input - not assigned	Switch on right	
Pt 100 (see information below)	1 2 3 4	not assigned Process actual 1 (current feed) Process actual 2 (GND) Process actual 3 (compensation)	Switch on right	

For reasons of wire compensation connect the Pt -100 sensor via 3 wires. Always bridge PIN 3 and PIN 4 on the sensor.

* *Can be adjusted by software (see chapter entitled "Procedure for Specifying the Basic Settings")*
** *The switch is situated behind the srew (see Fig. "Connection Profibus 8693")*

6 SETTINGS ON THE POSITIONER

The specification of the basic settings on the positioner can be found in the following chapters:

- Type 8692: *"Starting up and operating the position controller Type 8692" / "Starting up and setting up the position controller Type 8692"*
- Type 8693: *"Starting up and operating the position controller Type 8693" / "Starting up and setting up the process controller Type 8693"*

→ Specify the basic settings on the positioner (*ACTUATOR* and *X.TUNE*).

→ Implement the settings in the BUS.COMM menu option as described in the chapter entitled "*Explanations of the menu options in the BUS.COMM menu*" .

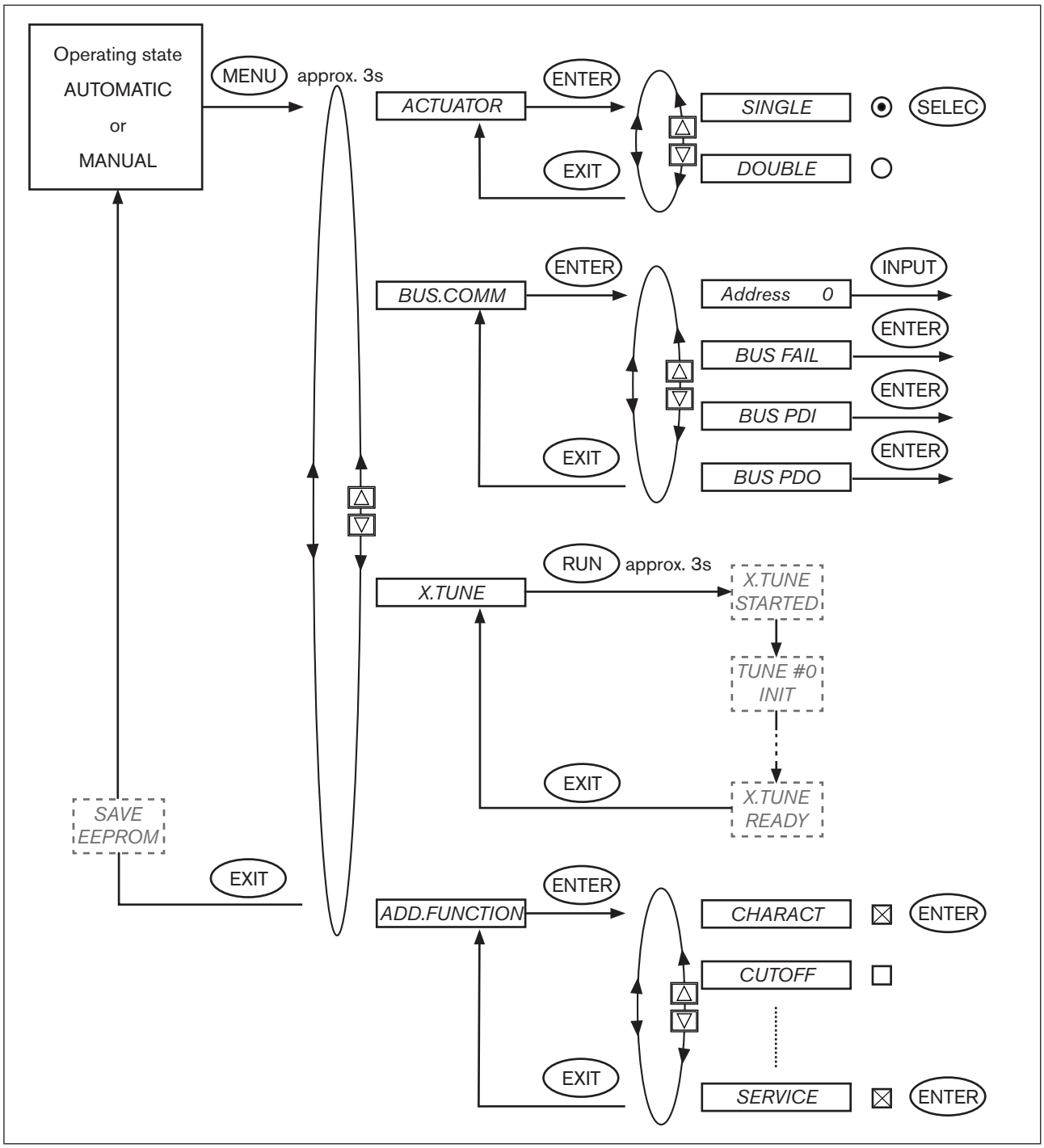


Fig. 4: Operating structure - basic settings - PROFIBUS

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6.1 Explanations of the Menu Options in the *BUS.COMM* Menu

6.1.1 BUS.COMM Menu for Type 8692

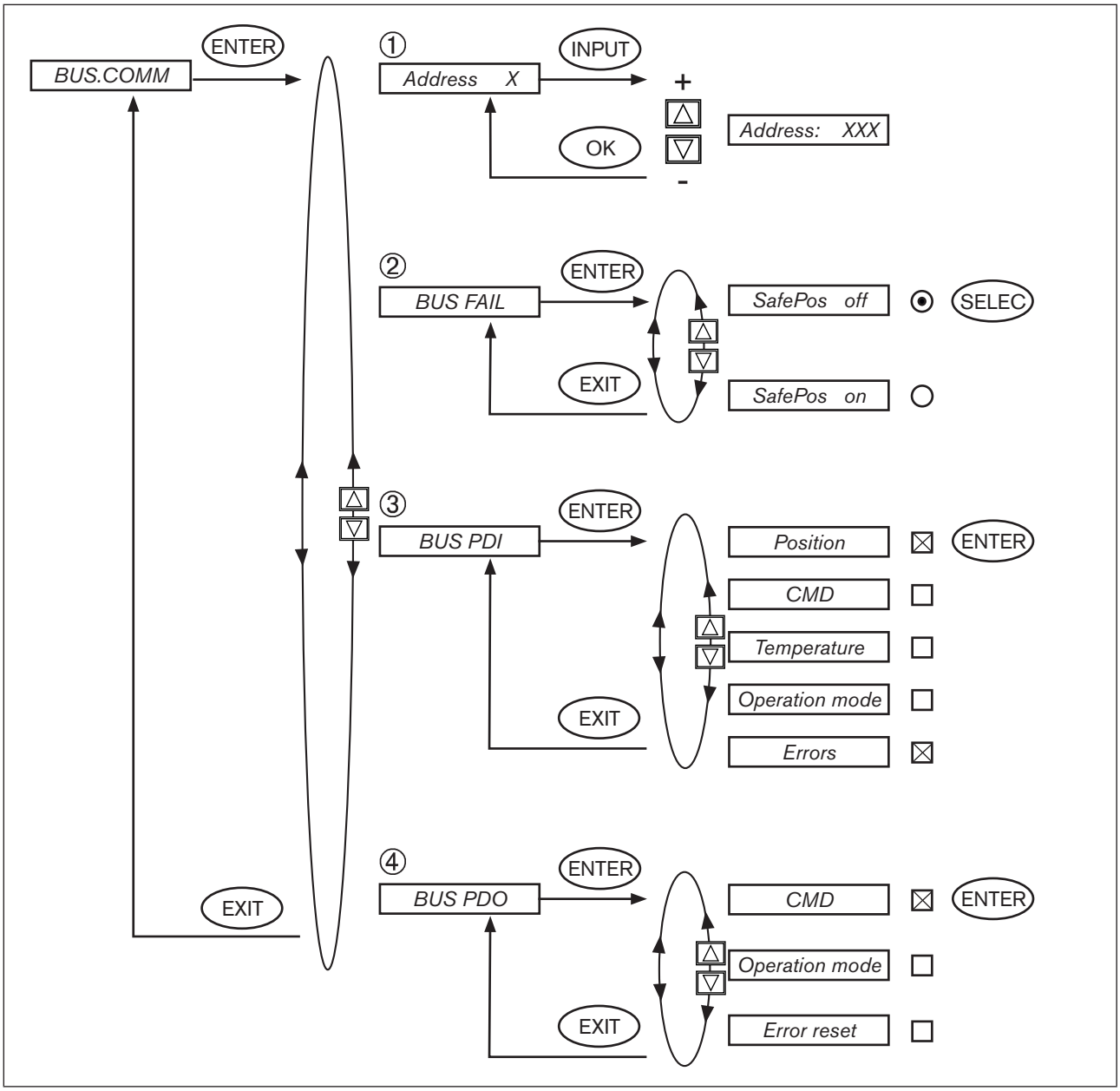

Fig. 5: Operating structure - BUS-COMM

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6.1.2 BUS.COMM Menu for Type 8693

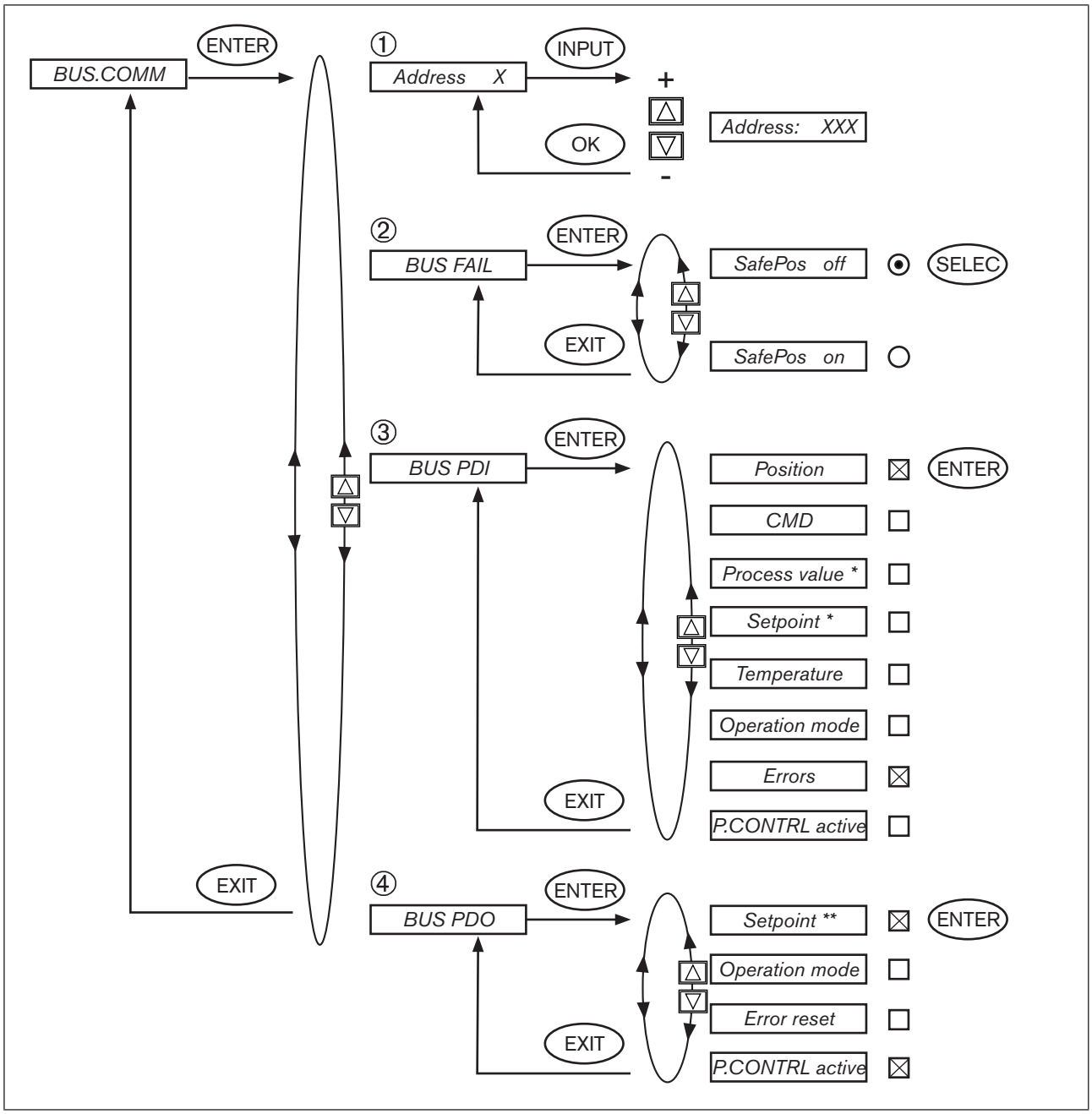

Fig. 6: Operating structure - BUS-COMM - 8693

* only when process controller activated
** only when process controller activated, otherwise CMD

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① *Address XXX*
Input the device address
Press the arrow keys (+/-) to set values from 0 – 126;
Confirm by pressing the selection key on the right (OK).

② *BUS FAIL*
Activate to approach the safety position if the bus communication fails

SafePos off
The position is approached which corresponds to the set-point value last transferred. (Default setting)

SafePos on
If *SafePos on* is set, the following configurations may occur:

- Active *SAFEPOS*
  menu option If a fault is detected in the bus communication, the drive moves to the lower *SAFEPOS* set position.
- Inactive *SAFEPOS*
  menu option If a fault is detected in the bus communication, the drive moves to the end position which it would specify in the isolated state.

③ *BUS PDI*
Selection of the process values which are to be transferred by the positioner to the controller (master).
Press the selection key on the right (ENTER) either to activate (x) or deactivate ( ) the respective process value.

Position
CMD
Process value *
Setpoint *
Temperature
Operation mode
Errors
P.CONTRL active **
For meaning of the process values see table *PDI: Process Data Input.*

④ *BUS PDO*
Selection of the process values which are to be transferred by the controller (master) to the positioner.
Press the selection key on the right (ENTER) either to activate (x) or deactivate ( ) the respective process value.

CMD / Setpoint *
Operation mode
Error reset
P.CONTRL active **
For meaning of the process values see table *PDO: Process Data Output.*

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7 FUNCTIONAL DEVIATIONS FROM THE STANDARD MODEL

It is possible to switch between the MANUAL and AUTOMATIC operating states on the process operating level either via the keyboard on the positioner or via the bus.

It is no longer possible to switch between MANUAL / AUTOMATIC on the keyboard if an operating mode (under *PDO MODE*) is transferred to the positioner via the bus.

* *only for type 8693 and when process controller activated*
** *only for type 8693*

8 CONFIGURATION IN THE PROFIBUS-DP MASTER

User parameters (hexparameters) are not required.

8.1 Configuration of the Process Values

Firstly the PDI (Process Data Input) is input (from the positioner to the controller).

PDI: **Process Data Input** (from the positioner to the controller)

Name	Description	Identifier
PDI:POS	Actual position (position) Actual value of position controller as ‰. Value range 0 – 1000. Values < 0 or > 1000 are possible if e.g. Autotune has not run through correctly.	GSD file: *PDI:POS* Identifier (HEX): 41, 40, 00
PDI:CMD	Nominal position (command) Set-point value of position controller as ‰. Value range 0 – 1000.	GSD file: *PDI:CMD* Identifier (HEX): 41, 40, 01
PDI:PV	Process actual value (process value) Actual value of process controller in physical unit (as set in the menu *P.CO INP* or *P.CO SCAL*), max. value range -999 – 9999, depending on internal scaling	GSD file: *PDI:PV* Identifier (HEX): 41, 40, 02
PDI:SP	Process set-point value (setpoint) Set-point value of process controller in physical unit (as set in the menu *P.CO INP* or *P.CO SCAL*), max. value range -999 – 9999, depending on internal scaling	GSD file: *PDI:SP* Identifier (HEX): 41, 40, 03
PDI:TEMP	Device temperature (temperature) Temperature of 0.1 °C is measured on the CPU board by the sensor, Value range -550 (-55 °C) – +1250 (+125 °C)	GSD file: *PDI:TEMP* Identifier (HEX): 41, 40, 04
PDI:MODE	Operating mode (operation mode) Operating mode: 0: *AUTO* 10: *P.TUNE* 1: *MANUAL* 12: *BUSSAFEPOS* 2: *XTUNE* 9: *P.QLIN*	GSD file: *PDI:MODE* Identifier (HEX): 41, 00, 05
PDI:ERR	Error Indicates the number of the process value (output) which was not written. The value is retained until it is deleted with *PDO:ERR*. HEX 14 *PDO:CMD / SP* 16 *PDO:MODE*	GSD file: *PDI:ERR* Identifier (HEX): 41, 00, 06
PDI: PCONact	0: Position controller (8692) 1: Process controller (8693)	GSD file: *PDI:PCONact* Identifier (HEX): 41, 00, 0A

PDI:PV and *PDI:SP* can be selected for Type 8693 (process controller) only and are beneficial only when process controller activated.
PDI:PCONact can be selected for Type 8693 (process controller) only.

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Then the process data output is input (from the controller to the positioner).

PDO: **Process Data Output**
(From the controller to the positioner)

Name	Description	Identifier
PDO:CMD / SP	**For position controller Type 8692:** Nominal position (input) Set-point value of position controller as ‰. Value range 0 – 1000 If the value is too small or too large, the last valid value is used and is indicated in *ERR* with HEX 14. **For process controller Type 8693:** Process set-point value (setpoint) Set-point value of process controller in physical unit (as set in the menu *P.CO INP* or *P.CO SCAL*), max. value range -999 – 9999, depending on internal scaling. If the value is too small or too large, the last valid value is used and is indicated in *ERR* with HEX 14.	GSD file: *PDO:CMD/SP* Identifier (HEX): 81, 40, 14
PDO:MODE	Operating mode (operation mode) Value range 0 , 1 or 12: 0: *AUTO* 12: *BUSSAFEPOS* 1: *MANUAL* If the value is too small or too large, the last valid value is used and is indicated in *ERR* with HEX 16.	GSD file: *PDO:MODE* Identifier (HEX): 81, 00, 16
PDO:ERR	Reset error display If the value > 0, *ERR* is reset	GSD file: *PDO:ERR* Identifier (HEX): 81, 00, 17
PDO: CONact	0: Position controller (8692) 1: Process controller (8693)	GSD file: *PDO:CONact* Identifier (HEX): 81, 00, 19

9 BUS STATUS DISPLAY

The bus status is indicated on the display on the device.

Display	Device status	Explanation/Troubleshooting
BUS offline is displayed approx. every 3 seconds	offline	Device is not connected to the bus ▪ Bus connection including plug assignment correct? ▪ Power supply and bus connection of the other nodes correct?

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10 CONFIGURATION WITH SIEMENS STEP7

10.1 Example 1 for a Position controller (Type 8692): Transfer of nominal and actual values

Procedure:

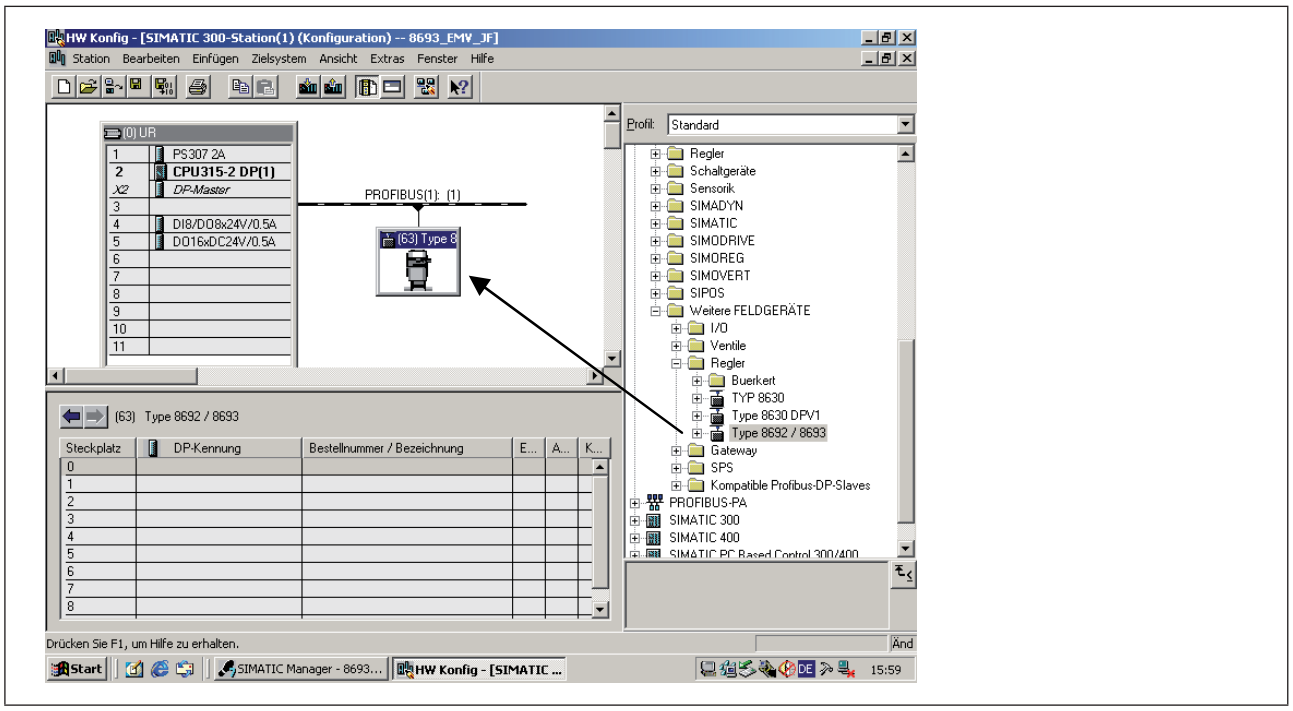

Fig. 7: Screenshot of Profibus Fig. 1

→ pull the slave *Type 8692 / 8693* by Drag & Drop to the bus line.

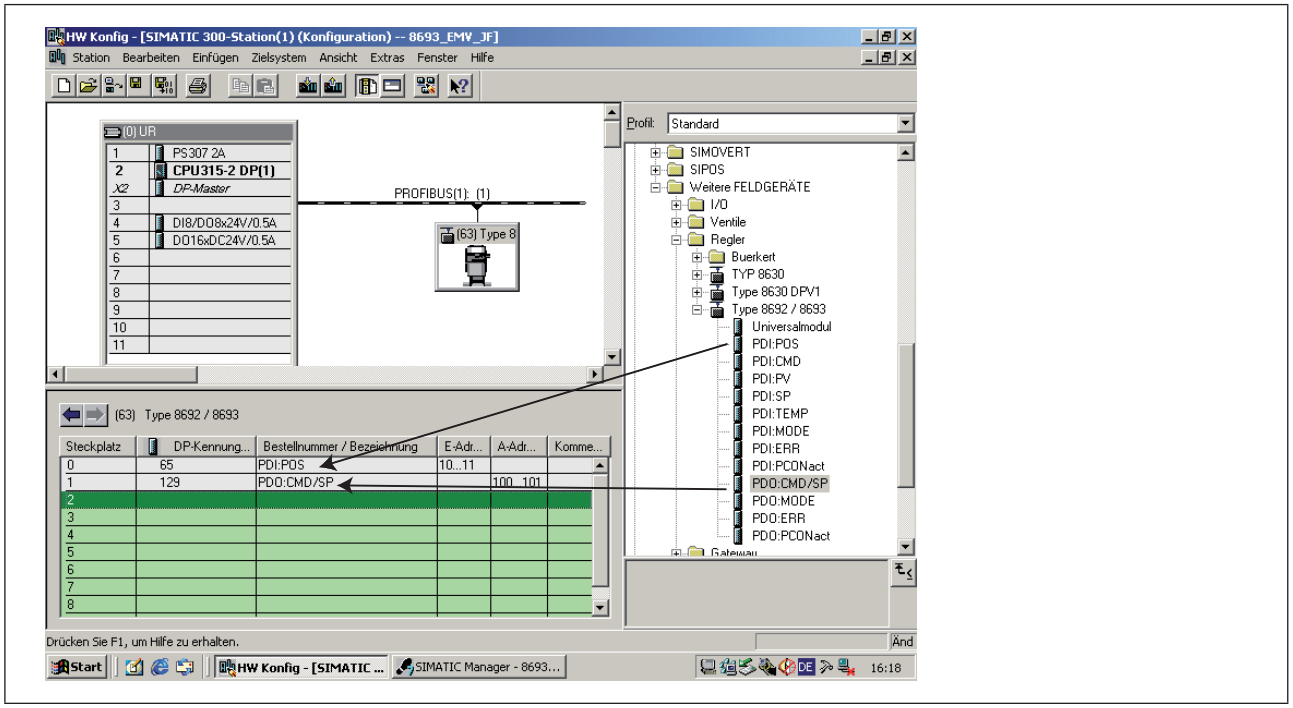

Fig. 8: Screenshot of position controller Fig. 2

→ pull the modules PDI:POS and PDO:CMD/SP into the slave Type 8692 / 8693 by Drag & Drop.

10.2 Example 2 for a Position controller (Type 8693): Transfer of several process values.

Procedure as in example 1.

→ pull the slave Type 8692 / 8693 by Drag & Drop to the bus line.

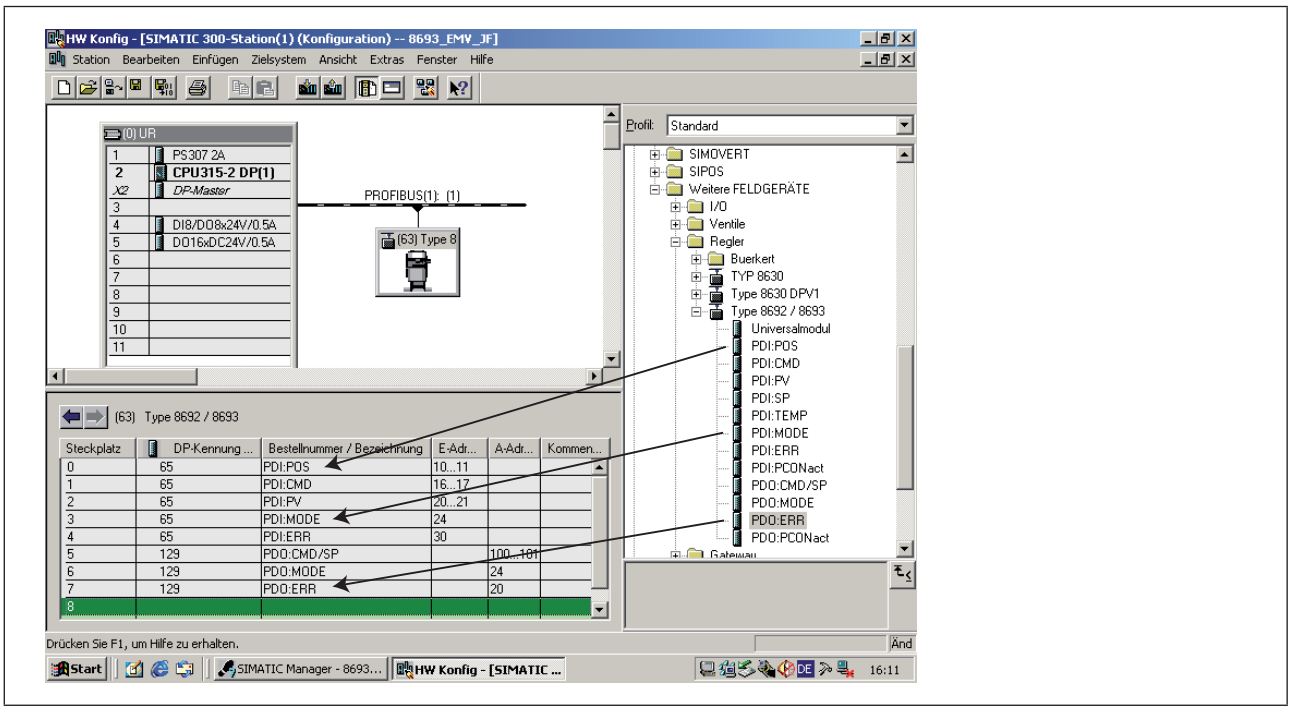

Fig. 9: Screenshot of position controller Fig. 3

→ pull the modules into the slave Type 8692 / 8693 by Drag & Drop.

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DeviceNet

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1 GENERAL INFORMATION

The following sections of the general operating instructions do not apply to the DeviceNet variant of the positioner 8692 / 8693:

- Variants of the positioner
- Initial start-up
- Electrical connection
- Specifying the standard settings
  - Function *INPUT*
  - Function *SPLTRNG*
  - Function *BINARY-IN*
  - Function *OUTPUT*
  - Function *CAL.USER / calibr. INP*
  - Function *CAL.USER / calibr. SP*

2 DEFINITION OF TERMS

DeviceNet

- The DeviceNet is a field bus system which is based on the CAN protocol (Controller Area Network). It enables actuators and sensors (slaves) to be networked with higher-level controllers (master).
- The positioner in the DeviceNet is a slave device according to the Predefined Master/Slave Connection Set stipulated in the DeviceNet specification. Polled I/O, Bit Strobed I/O and Change of State (COS) are supported as an I/O connection variant.
- With DeviceNet it is necessary to differentiate between cyclical or event-driven high-priority process messages (I/O Messages) and acyclical low-priority management messages (Explicit Messages).
- The protocol process conforms to the **DeviceNet specification Release 2.0.**

3 TECHNICAL DATA

EDS file	BUER8692.EDS
Icons	BUER8692.ICO
Baudrate	125 kbit/s, 250 kbit/s, 500 kbit/s (can be adjusted by pressing operator keys on the device or via network); Factory setting 125 kbit/s
Address	0 – 63; (can be adjusted by pressing operator keys on the device or via network); Factory setting 63
Process data	7 static input assemblies (Input: from the positioner to the DeviceNet master/scanner) 4 static output assemblies

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Total line length according to DeviceNet Specification
(Total line length = total of all trunk and drop lines)

Baudrate	Maximum total line length	
	Thick cable	Thin cable
125 kbaud	500 m	100 m for all baudrates
250 kbaud	250 m	
500 kbaud	100 m	

Drop line length

Baudrate	Length of the drop lines	
	Maximum length	Maximum total length Drop lines in the network
125 kbaud	6 m for all baudrates	156 m
250 kbaud		78 m
500 kbaud		39 m

4 SAFETY SETTINGS IF THE BUS FAILS

If the bus fails, the position is approached which corresponds to the set-point value last transferred (default setting).

Other setting options (see chapter entitled "*Settings on the positioner*").

5 INTERFACES

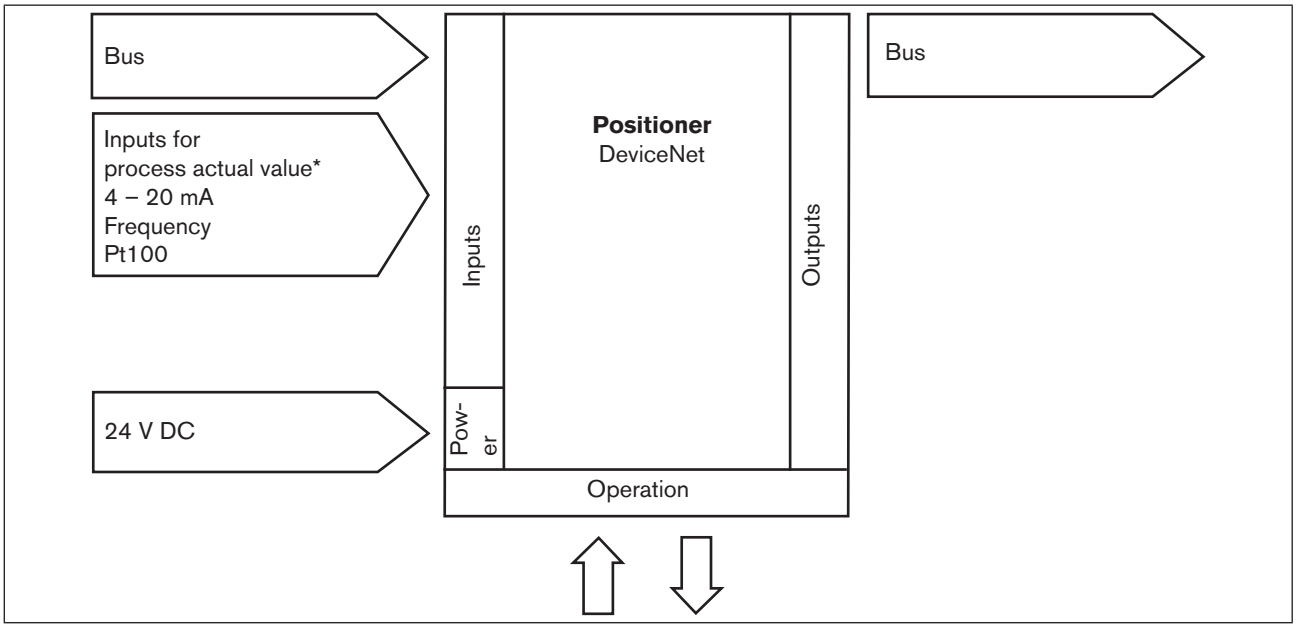

Fig. 1: DeviceNet interfaces

* *only for process controller Type 8693*

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6 ELECTRICAL CONNECTIONS

DANGER!

Danger - electrical voltage in the equipment!

There is a serious risk of injury when reaching into the equipment.

- Before starting work, always switch off the power supply and safeguard to prevent re-activation!

WARNING!

Danger - improper installation!

Improper installation may result in injuries as well as damage to the device and the area around it.

- Fluid and electrical installations may be carried out by authorised technicians only and with the appropriate tools!

Danger due to unintentional activation of the equipment!

Unintentional activation of the equipment during installation may result in injuries and damage.

- Take appropriate measures to prevent the equipment from being unintentionally activated.

→ For operation of the device always connect the 5-pole (bus) and the 4-pole M12 round plug (power supply).

The connection module of Type 8692 and 8693 features a setscrew with nut which is used to connect the Technical Earth (see diagram).

→ Connect the setscrew to a suitable earthing point.
To ensure electromagnetic compatibility (EMC), ensure that the cable is as short as possible (max. 30 cm, Ø 1.5 mm²).

6.1 Connection Diagram Type 8692

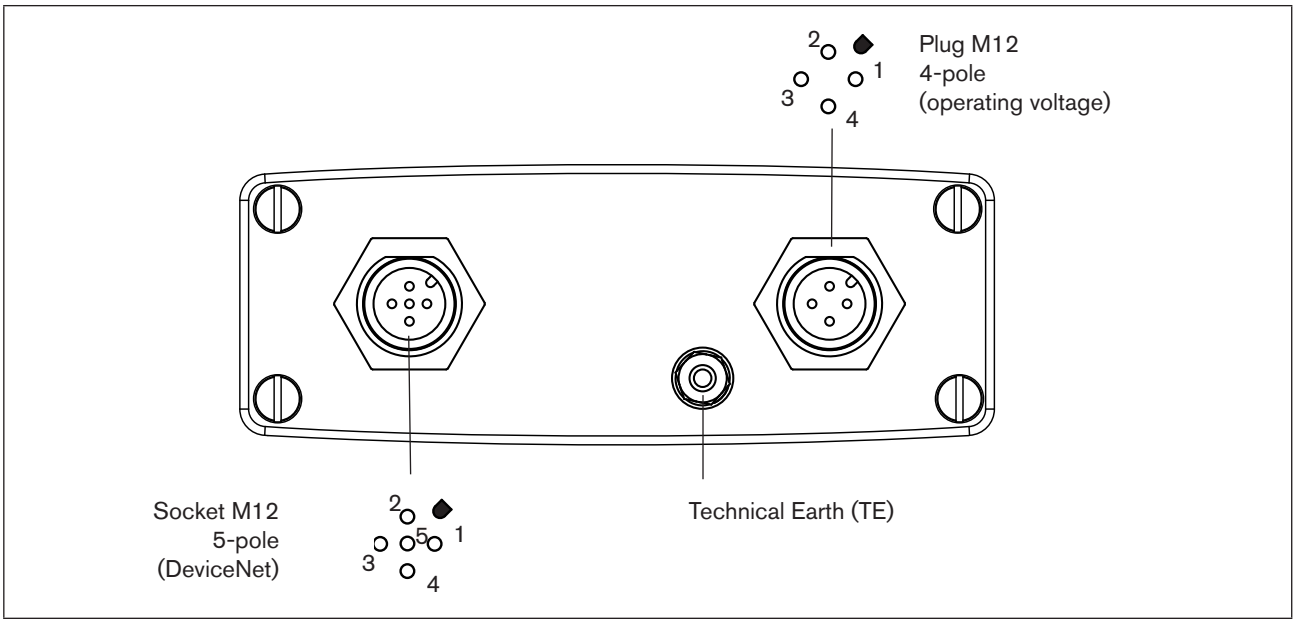

Fig. 2: Connection of DeviceNet-8692

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6.2 Connection Diagram Type 8693

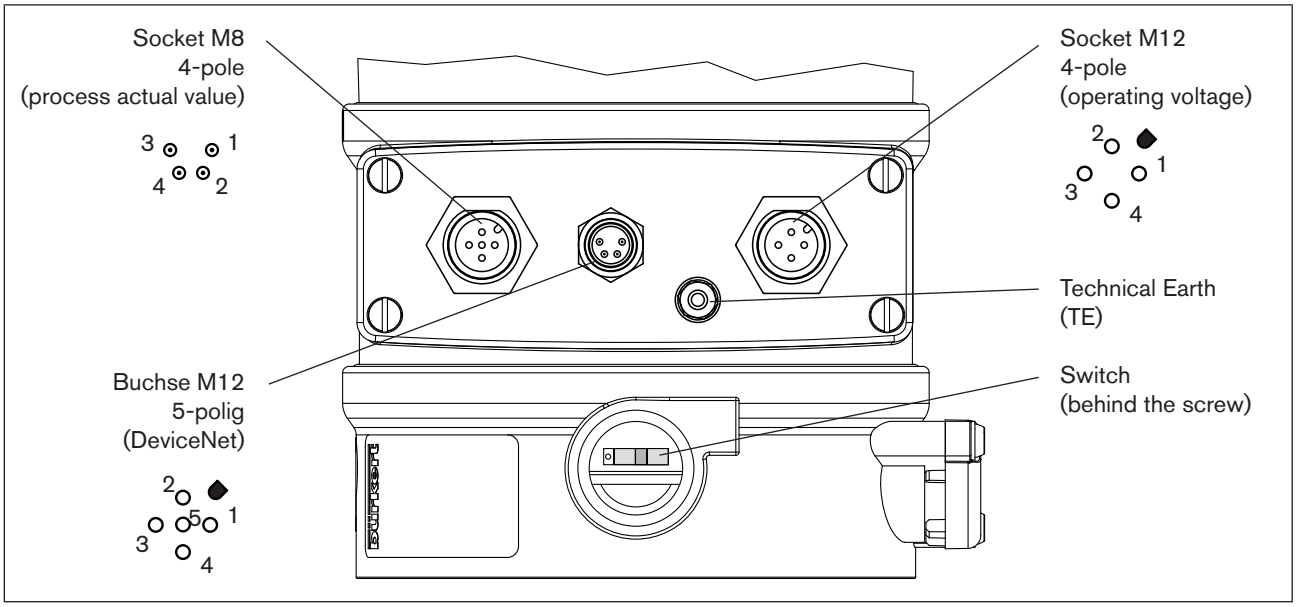


Fig. 3: Connection of DeviceNet-8693

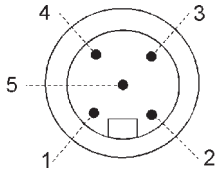
The power supply to the device is not supplied via the DeviceNet voltage V+ und V-, but via the operating voltage galvanically isolated from the DeviceNet.

6.3 Operating Voltage (M12 Round Plug, 4-pole)

PIN	Configuration	External circuit
1	+ 24 V	1 — 3: 24 V DC ± 10 %, max. residual ripple 10 %
2	not used	
3	GND	
4	not used	

6.4 Bus Connection (M12 Round Plug, 5-pole)

PIN	Signal	Colour
1	Shielding	not used
2	V +	not used
3	V-	not used
4	CAN H	white
5	CAN L	blue



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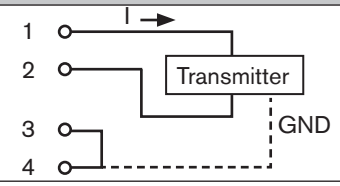
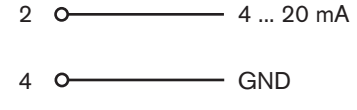
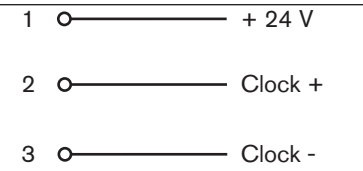
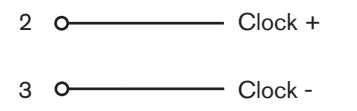
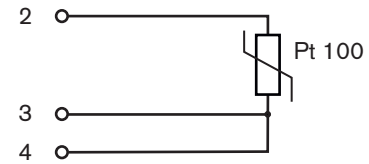
6.5 Process Actual Value (M 8 Round Plug)

Input type*	Pin	Configuration	Switch**	External circuit
4 – 20 mA - internally supplied	1 2 3 4	+ 24 V transmitter supply Output from transmitter GND Bridge after GND (GND from 3-wire transmitter)	Switch on left	
4 – 20 mA - externally supplied	1 2 3 4	not assigned Process actual + not assigned Process actual -	Switch on right	
Frequency - internally supplied	1 2 3 4	+ 24 V sensor supply Clock input + Clock input - (GND) not assigned	Switch on left	
Frequency - externally supplied	1 2 3 4	not assigned Clock input + Clock input - not assigned	Switch on right	
Pt 100 (see information below)	1 2 3 4	not assigned Process actual 1 (current feed) Process actual 2 (GND) Process actual 3 (compensation)	Switch on right	

For reasons of wire compensation connect the Pt 100 sensor via 3 wires.
Always bridge PIN 3 and PIN 4 on the sensor.

6.6 Terminating Circuit for DeviceNet Systems

When installing a DeviceNet system, ensure that the terminating circuit of the data lines is correct. The circuit prevents the occurrence of interference caused by signals reflected onto the data lines. The trunk line must be terminated at both ends with resistors of 120 Ω each and 1/4 W power loss.

(see figure 4: *Network topology, DeviceNet*)

* *Can be adjusted by software.*
** *The switch is situated behind the srew (see Fig. "Connection of DeviceNet-8693").*

6.7 Network Topology of a DeviceNet System

Line with one trunk line and several drop lines.
Trunk lines and drop lines consist of identical material (see diagram).

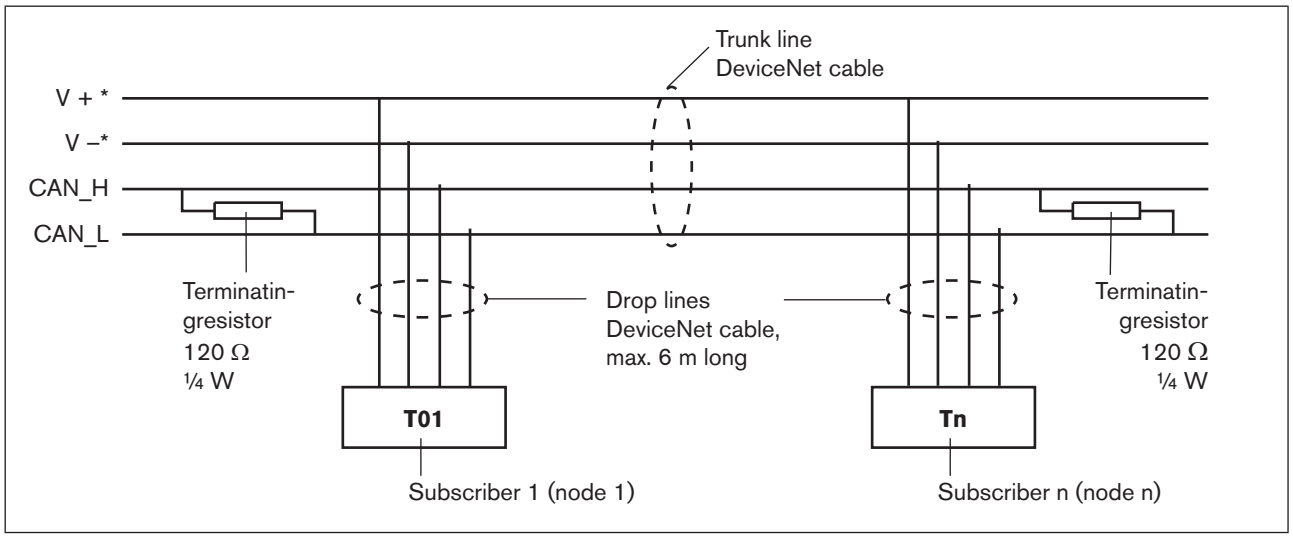


Fig. 4: Network topology, DeviceNet

* *not assigned, as separate power supply*

7 SETTINGS ON THE POSITIONER IN THE MAIN MENU

The specification of the basic settings on the positioner can be found in the following chapters:

- Type 8692: *"Starting up and operating the position controller Type 8692" / "Starting up and setting up the position controller Type 8692"*
- Type 8693: *"Starting up and operating the position controller Type 8693" / "Starting up and setting up the process controller Type 8693"*

→ Specify the basic settings on the positioner (*ACTUATOR* and *X.TUNE*).

→ Implement the settings in the BUS.COMM menu option as described in the chapter entitled "Explanations of the menu options in the *BUS.COMM*" menu.

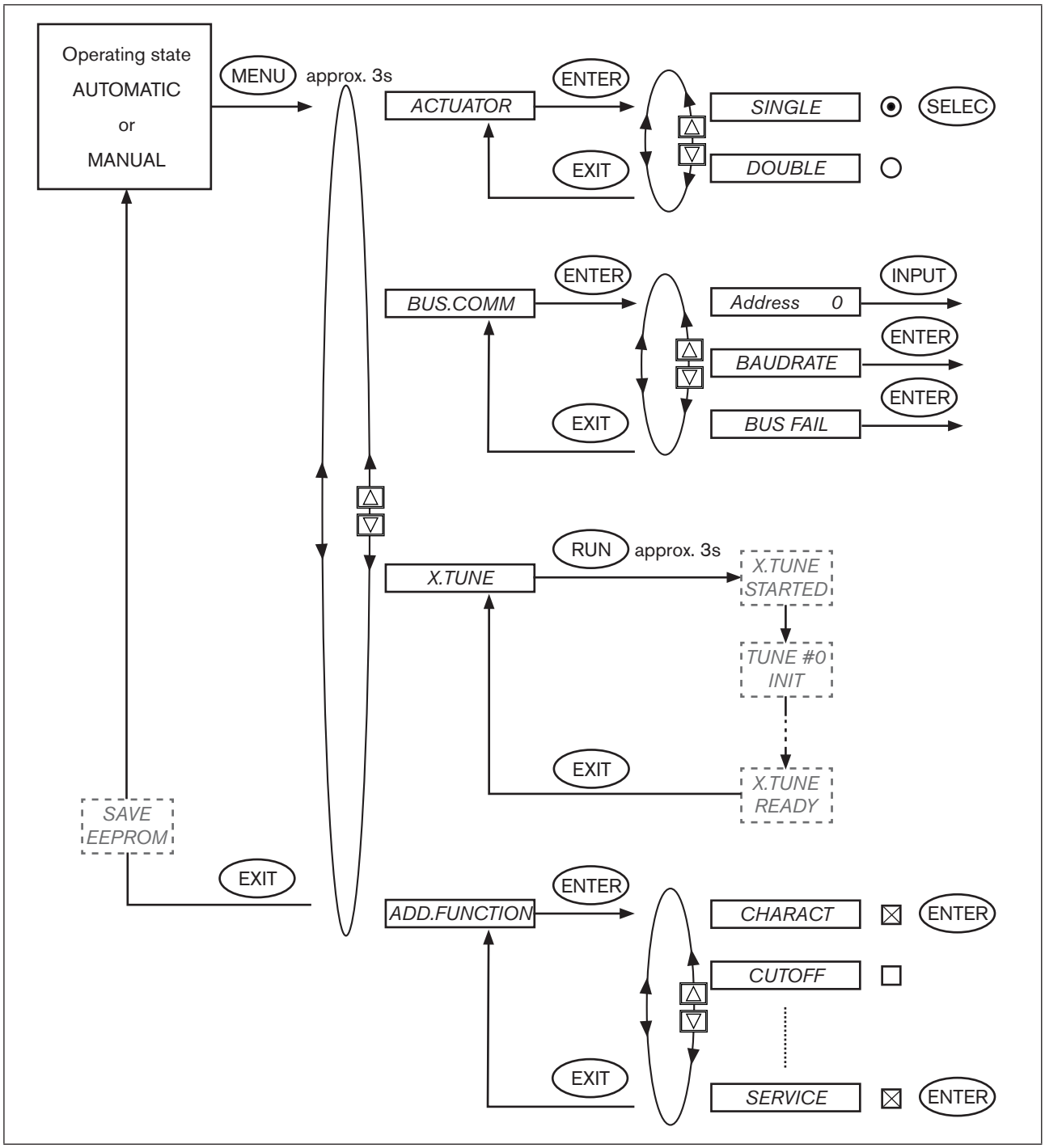


Fig. 5: Operating structure of basic settings, DeviceNet

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7.1 Explanations of the Menu Options in the *BUS.COMM* Menu

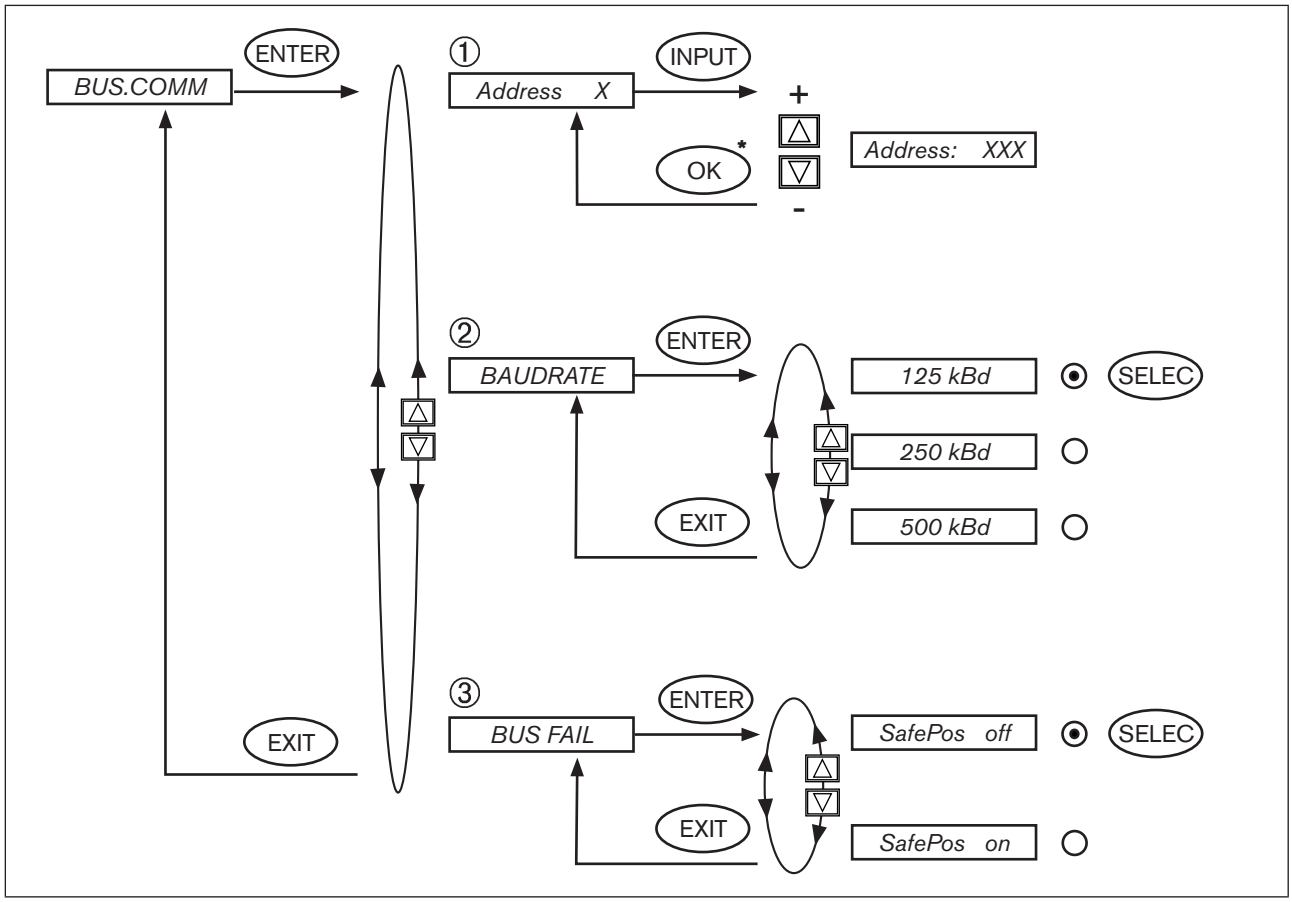

Fig. 6: Operating structure - BUS-COMM - DeviceNet

① *Address XXX*

Input the device address

Press the arrow keys (+/-) to set values from 0 – 63;

Confirm by pressing the selection key on the right (OK).

② *BAUDRATE*

SafePos off

SafePos on

The baudrate can be changed either by pressing the operator keys on the device or via the bus. In either case a change has no effect until a reset (send a reset message to the identity object) or power up is implemented. This means if the changed baudrate attribute is accessed before a reset or power up, the read (changed) value does not agree with the still current baudrate (to be changed) of the network.

Select 125 kbit/s, 250 kbit/s or 500 kbit/s

③ *BUS FAIL*

Activate to approach the safety position if the bus communication fails.

SafePos off

The position is approached which corresponds to the set-point value last transferred. (Default setting)

SafePos on

If *SafePos on* is set, the following configurations may occur:

- Active *SAFEPOS* menu option If a fault is detected in the bus communication, the actuator moves to the lower *SAFEPOS* set position.
- Inactive *SAFEPOS* menu option If a fault is detected in the bus communication, the actuator moves to the end position which it would specify in the isolated state.

** If the sub-menu is left by pressing the selection key on the left (ESC), the value remains unchanged.*

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8 FUNCTIONAL DEVIATIONS FROM THE STANDARD MODEL

It is possible to switch between the MANUAL and AUTOMATIC operating states on the process operating level either via the keyboard on the positioner or via the bus.

It is no longer possible to switch between MANUAL / AUTOMATIC on the keyboard if an operating mode (under *PDO MODE*) is transferred to the positioner via the bus.

9 CONFIGURATION OF THE PROCESS DATA

To **transmit process data** via an I/O connection, 5 static input and 2 static output assemblies can be selected. These assemblies contain selected attributes combined into one object so that process data can be transmitted collectively via an I/O connection.

The **process data** is selected by setting the device parameters Active Input Assembly and Active Output Assembly or - if supported by the DeviceNet-Master/Scanner - by setting Produced Connection Path and Consumed Connection Path when an I/O connection is initialised according to the DeviceNet specification.

9.1 Static Input Assemblies

Name	Address of data attribute of the assemblies for read access. Class, Instance, Attribute	Format of the data attribute
POS+ERR (factory setting)	4, 1, 3	Byte 0: POS low Byte 1: POS high Byte 2: ERR
POS+CMD+ERR	4, 2, 3	Byte 0: POS low Byte 1: POS high Byte 2: CMD low Byte 3: CMD high Byte 4: ERR
PV+ERR	4, 3, 3	Byte 0: PV low Byte 1: PV high Byte 2: ERR
PV+SP+ERR	4, 4, 3	Byte 0: PV low Byte 1: PV high Byte 2: SP low Byte 3: SP high Byte 4: ERR
PV+SP+CMD+ERR	4, 5, 3	Byte 0: PV low Byte 1: PV high Byte 2: SP low Byte 3: SP high Byte 4: CMD low Byte 5: CMD high Byte 6: ERR

The addresses indicated in the Static Input Assemblies table can be used to specify a path for the Produced Connection Path attribute of an I/O connection, whereby the attributes described in more detail in the following table can be transferred as input process data via this I/O connection. Nevertheless, by using this address data, the attributes combined in the assemblies can also be accessed acyclically via Explicit Messages .

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Name	Description of the input data attributes	Attribute Address Class, Instance, Attribute; Data type, Length
POS	Actual position Actual value of position controller as ‰. Value range 0–1000. However, values <0 or >1000 also possible if e.g. Autotune has not run through correctly.	111, 1, 59; INT, 2 byte
CMD	Nominal position Set-point value of position controller as ‰. Value range 0–1000.	111, 1, 58; UINT, 2 byte
PV *	Process actual value (process value) Actual value of process controller in physical unit (as set in the menu *P.CO INP* or *P.CO SCAL*), max. value range –999–9999, depending on internal scaling.	120, 1, 3; INT, 2 byte
SP *	Process set-point value Set-point value of process controller in physical unit (as set in the menu *P.CO INP* or *P.CO SCAL*), max. value range –999–9999, depending on internal scaling.	120, 1, 2; INT, 2 byte
ERR	Error Indicates the number of the process value (output) which was not written. The value is retained until it is deleted with “1” by acyclically writing the “Error” attribute (access via Explicit Message – Set Attribute Single). HEX 0X14 INP 0X15 SP	100, 1, 1; USINT, 1 byte

* *relevant only for type 8693 and when process controller activated.*

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9.2 Static Output Assemblies

Name	Address of data attribute of the assemblies for read access. Class, Instance, Attribute	Format of the data attribute
INP (factory setting)	4, 21, 3	Byte 0: INP low Byte 1: INP high
SP	4, 22, 3	Byte 0: SP low Byte 1: SP high

The addresses indicated in the *Static Output Assemblies* table can be used to specify a path for the *Consumed Connection Path* attribute of an I/O connection, whereby the attributes described in more detail in the following table can be transferred as output process data via this I/O connection. Nevertheless, by using this address data, the attributes combined in the assemblies can also be accessed acyclically via *Explicit Messages* .

Name	Description of the output data attributes	Attribute Address Class, Instance, Attribute; Data type, Length
INP	Nominal position Set-point value of position controller as ‰. Value range 0–1000. In "pure" position controller mode (*P.CONTRL* inactive) the transfer of the nominal position *INP* is required; as a process controller (*PCONTRL* active) the transfer of *INP* is not possible. If the value is too small or too large, the last valid value is used and is indicated in *ERR* with HEX 14.	111, 1, 58; UINT, 2 byte
SP *	Process set-point value Set-point value of process controller in physical unit (as set in the menu *P.CO INP* or *P.CO SCAL*), max. value range –999–9999, depending on internal scaling. If the value is too small or too large, the last valid value is used and is indicated in *ERR* with HEX 15.	120, 1, 2; INT, 2 byte

* *relevant only for type 8693 and when process controller activated.*

10 BUS STATUS DISPLAY

The bus status is indicated on the display on the device.

Display	Device status	Explanation/Troubleshooting
BUS offline is displayed approx. every 3 seconds	offline	Device is not connected to the bus, the network access procedure (duplicate MAC-ID test, duration approx. 2 s) has still not ended or device is only active network node ▪ Baudrate correctly set across network? ▪ Bus connection including plug assignment correct? ▪ Power supply and bus connection of the other nodes correct?
BUS no connection is displayed approx. every 3 seconds	online, no connection to the master	Device is connected correctly to the bus, the network access procedure has ended without errors, however there is no established connection to the master.
BUS no timeout is displayed approx. every 3 seconds	I/O connection timeout	An I/O connection is in the *TIME OUT* state. → New connection establishment by master; ensure that I/O data is transferred cyclically or, if *COS* confirmed, that corresponding Acknowledge messages are sent by the master.
BUS critical err is displayed approx. every 3 seconds	Critical bus error	Other device with the same address in the network or *BUS OFF* due to communication problems. → Change address of the device and restart device → Error analysis in the network with a bus monitor.

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11 CONFIGURATION EXAMPLE 1

The example describes the principle procedure when configuring the device using the software *RSNetWorx for DeviceNet* (Rev. 4.12.00).

11.1 Installation of the EDS File

The EDS file supplied on the CD is installed with the aid of the EDS Installation Wizard Tool associated with RSNetWorx.

During the installation procedure the icon also supplied on CD can be assigned (if this does not occur automatically).

11.2 Address Assignment

There are two options of assigning an address to the devices.

On the one hand the address can be set by pressing the operator keys on the device to the required value within the range 0 – 63 (see chapter entitled *Settings on the positioner*), on the other hand the address can be changed from connected devices via the bus with the aid of the Node Commissioning Tool associated with RSNetWorx. Therefore devices with the default address 63 can also be inserted sequentially into an existing network without difficulty.

Fig. 7 indicates how the new address 2 is assigned to a device with address 63.

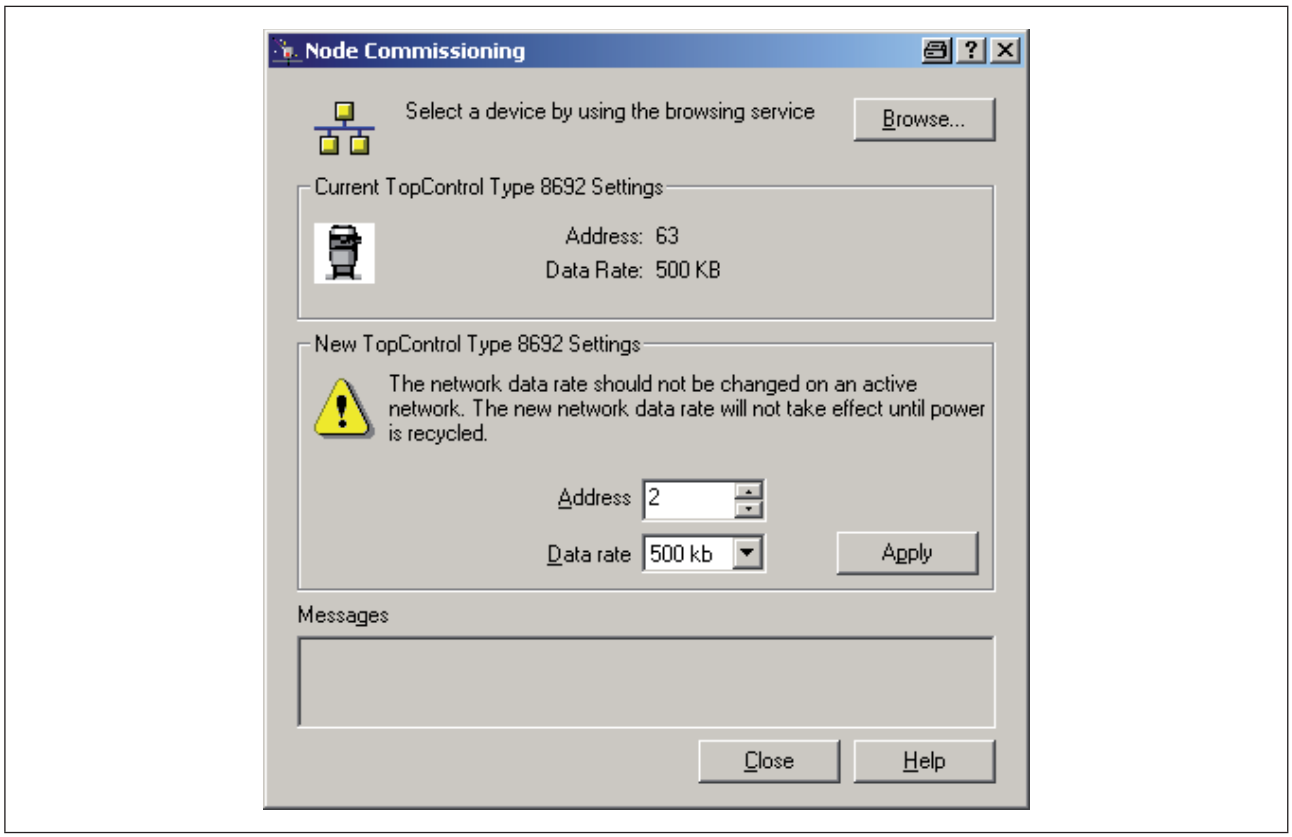

Fig. 7: Screenshot - DeviceNet - Fig. 1

11.3 Offline Parameterisation of the Device

When a device has been inserted into the DeviceNet configuration of *RSNetWorx*, the device can be parameterised offline.

Fig. 8 indicates how, for example, an input assembly which deviates from the factory setting (input process data can be transferred via I/O connection) can be selected. However, ensure that the length of the process data during a subsequent configuration of the DeviceNet master/scanner is adjusted accordingly (see chapter entitled *Configuration Example 2*).

All parameter changes implemented offline must become operative for the real device at a later date by a download process.

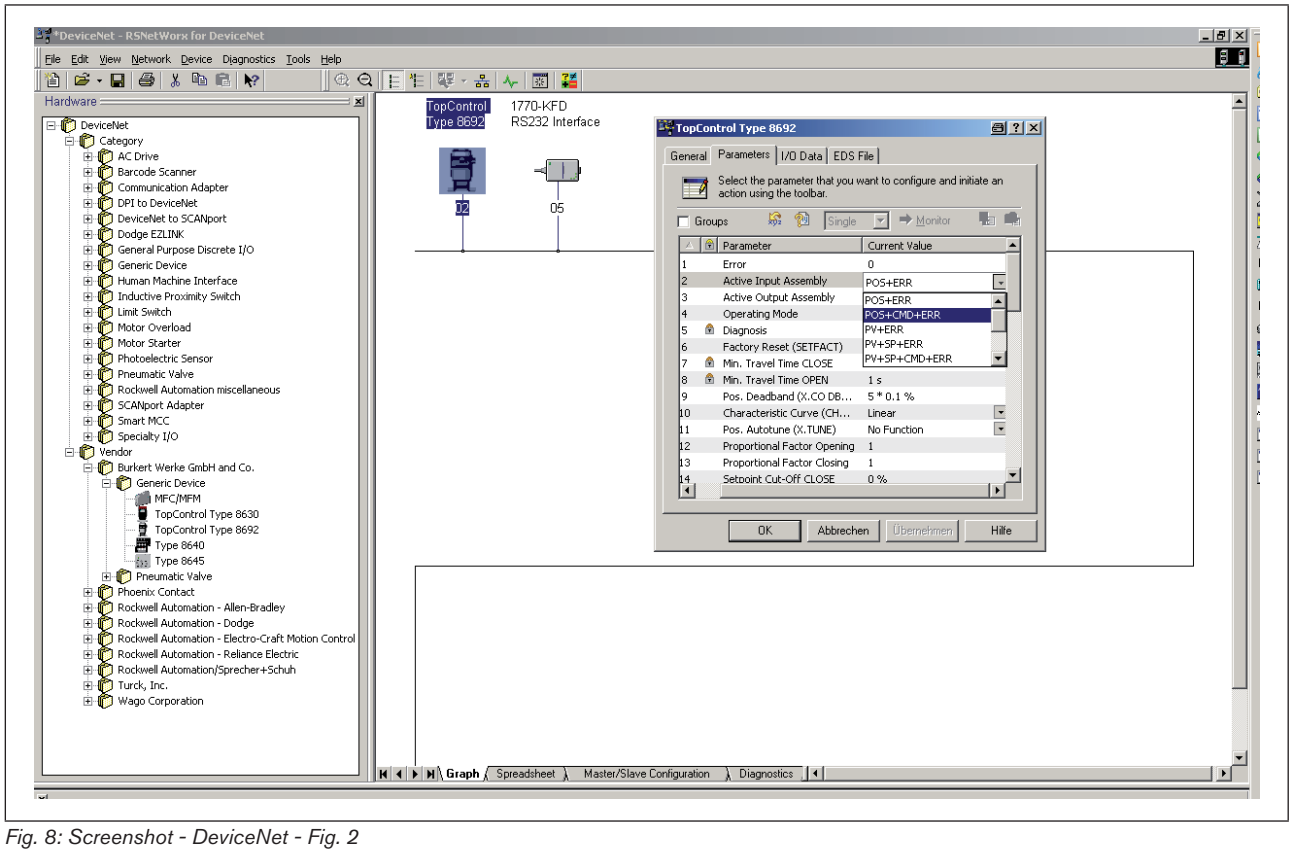

Fig. 8: Screenshot - DeviceNet - Fig. 2

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10.4 Offline Parameterisation of the Device

Devices can also be parameterised online. In doing so, you can also select whether only individual parameters (single) or all parameters (all) of a group are read from the device (upload) or are loaded into the device (download).

It is also possible to transfer individual parameters or all parameters of a group cyclically in monitor mode. This may be helpful particularly for start-up purposes.

Fig. 9 indicates the group of the process values or diagnosis information. If *Monitor* is actuated, these values are updated cyclically. However, Explicit Messages are used for this cyclical access (no I/O connections).

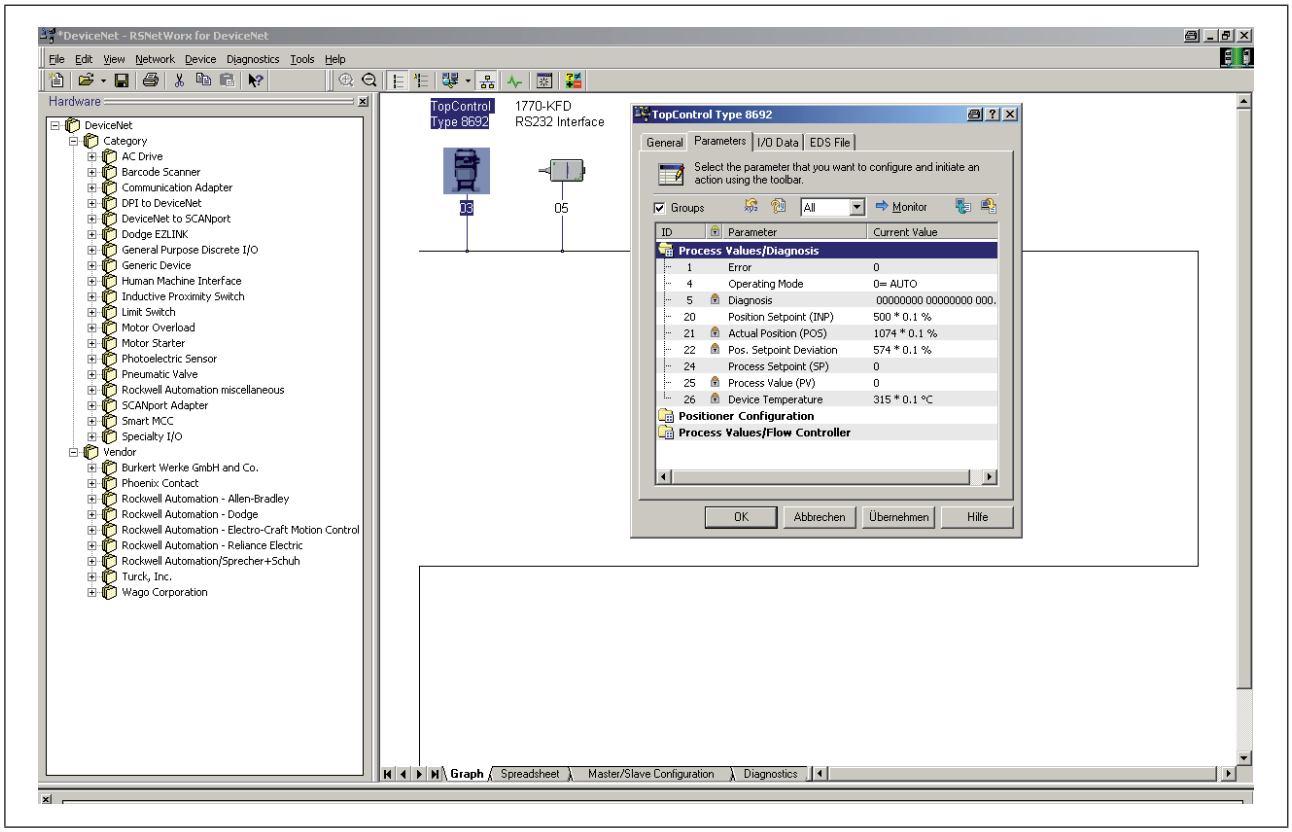

Fig. 9: Screenshot - DeviceNet - Fig. 3

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12 CONFIGURATION EXAMPLE 2

This example describes the principle procedure for setting up the process image of a DeviceNet master/scanner using the software *RSNetWorx for DeviceNet* (Rev. 4.12.00).

Setting up the *scan list* and setting the I/O parameters

First of all the *scan list* of the DeviceNet master/scanner is set up. To do this, the devices listed in the left part of the corresponding window are included in the scan list in the right part of the window. Then the I/O parameters can be changed for each device included in the scan list. This is required if assemblies which differ from the default settings were selected during configuration of the positioner in question.

Fig. 10 indicates the setting of the I/O parameters when

Input Assembly *POS+CMD+ERR* (5 bytes long) is selected and when

Output Assembly *INP* (2 bytes long; Default Assembly - no change required) is selected

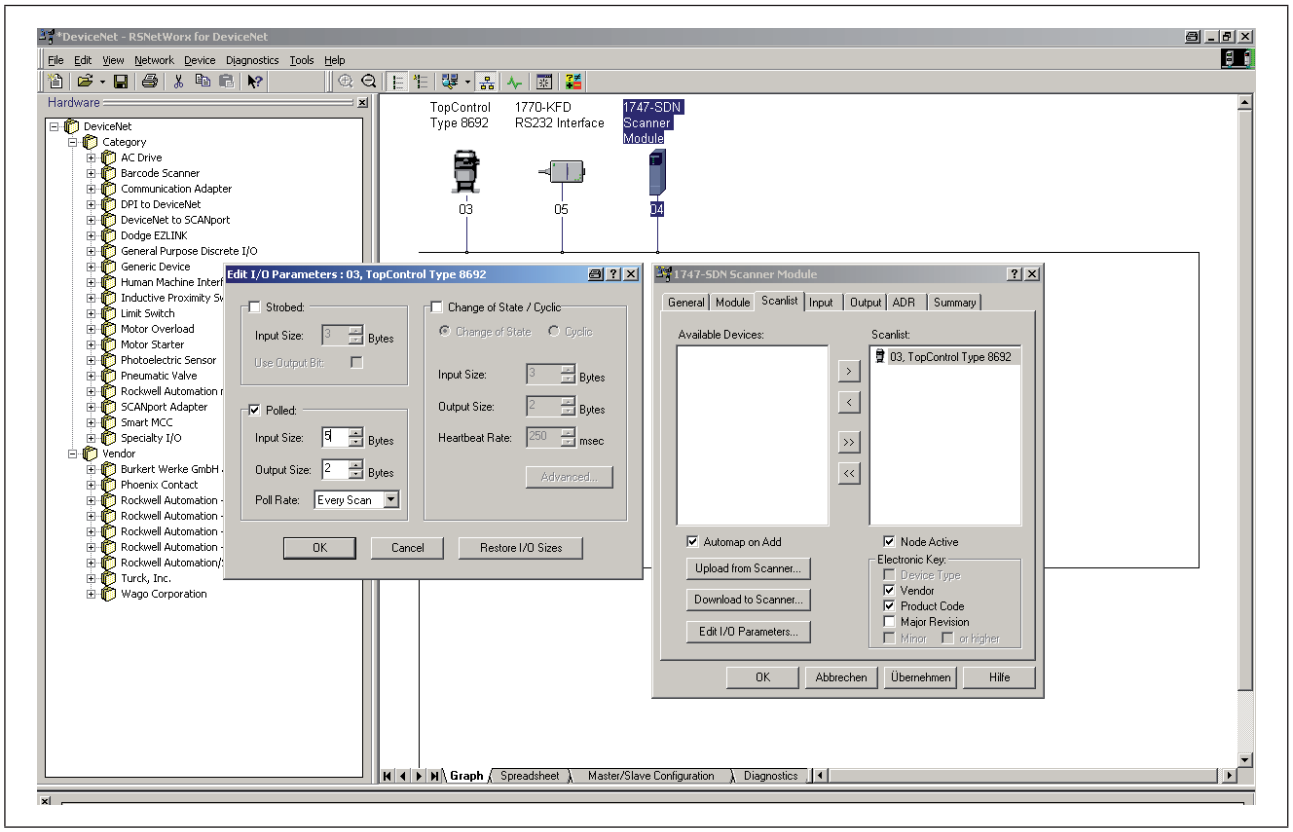

Fig. 10: Screenshot - DeviceNet - Fig. 4

12.1 Setting up the Process Image (Mapping)

The *AUTOMAP* function is used to assign the input data of the devices specified in the scan list to the process image of the DeviceNet master/scanner.

Our example of the assignment is indicated in Fig. 11.

For example the input process values of the positioner with address 3 are assigned to the internal addresses of the scanner as follows:

Actual position	I:1.1
Nominal position	I:1.2
Error	I:1.3

Therefore, if the actual position of the positioner with address 3 is to be read from a control program, this is done by accessing I:1.1.

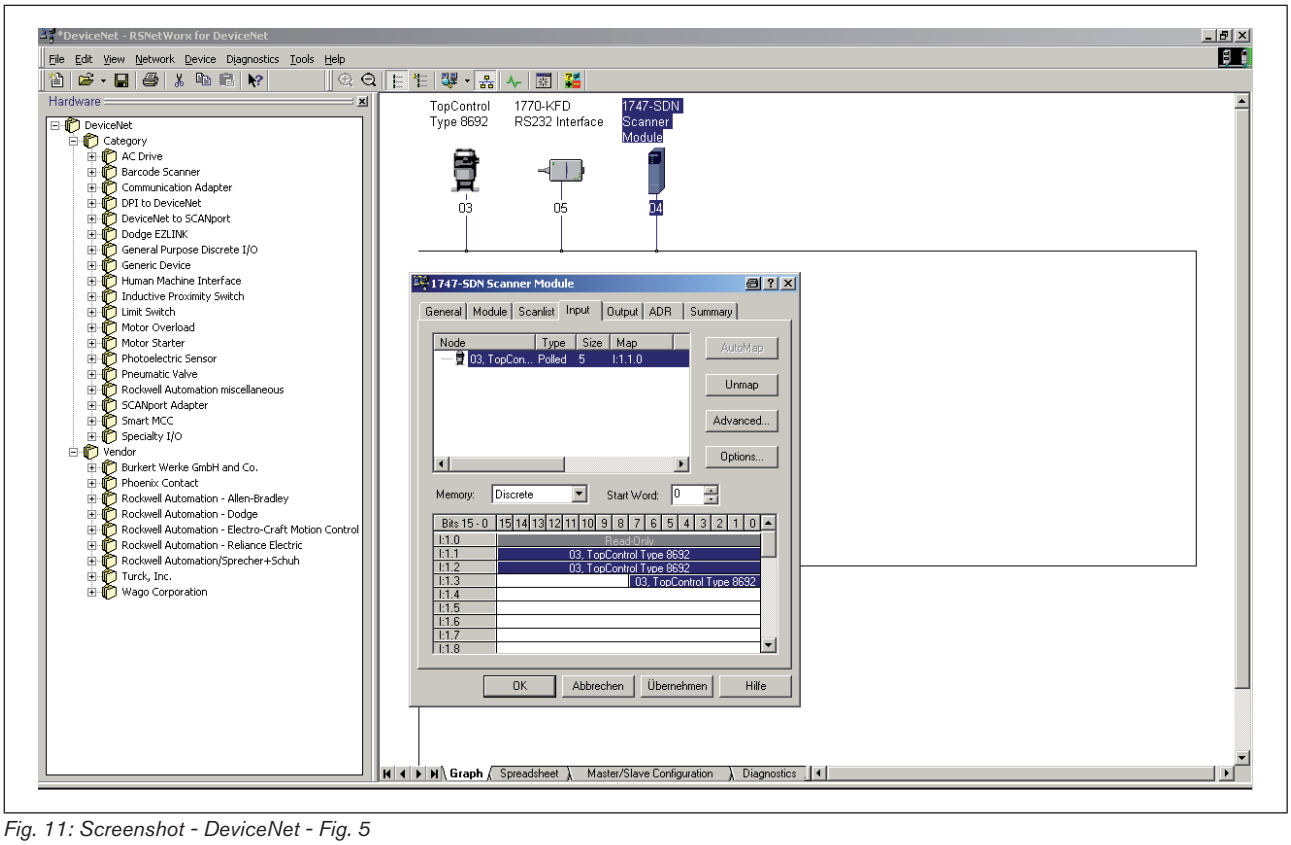

Fig. 11: Screenshot - DeviceNet - Fig. 5

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Servicing and Troubleshooting the Position Controller Type 8692

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1 MAINTENANCE

The **positioner Type 8692** is maintenance-free when operated according to the instructions indicated in this manual**.**

2 ERROR MESSAGES AND MALFUNCTIONS

2.1 Error Messages on the Display

2.1.1 General Error Messages

Display	Causes of error	Remedial action
	Minimum input value has been reached	Do not reduce value further
	Maximum input value has been reached	Do not increase value further
CMD error	Signal error Set-point value position controller	Check signal
EEPROM fault	EEPROM defective	not possible, device defective
*MFI fault **	Field bus board defective	
invalid code	Incorrect access code	Input correct access code

2.1.2 Error Messages while the *X.TUNE* Function is Running

Display	Causes of error	Remedial action
X.TUNE locked	The *X.TUNE* function is blocked	Input access code
X.TUNE ERROR 1	No compressed air connected	Connect compressed air
X.TUNE ERROR 2	Compressed air failed during Autotune	Check compressed air supply
X.TUNE ERROR 3	Actuator or control system deaeration side leaking	not possible, device defective
X.TUNE ERROR 4	Control system aeration side leaking	not possible, device defective
X.TUNE ERROR 6	The end positions for *POS-MIN* and *POS-MAX* are too close together	Check compressed air supply
X.TUNE ERROR 7	Incorrect assignment *POS-MIN* and *POS-MAX*	To determine *POS-MIN* and *POS-MAX* , move the actuator in the direction indicated on the display.

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2.2 Other Malfunctions

Problem	Possible causes	Remedial action
POS = 0 (when *CMD* > 0 %) or *POS* = 100 %, (when *CMD* < 100 %)	Sealing function (*CUTOFF*) has been unintentionally activated	Deactivate sealing function

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Servicing and Troubleshooting the Process Controller Type 8693

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1 MAINTENANCE

The **positioner type 8693** is maintenance-free when operated according to the instructions indicated in this manual**.**

2 ERROR MESSAGES AND MALFUNCTIONS

2.1 Error Messages on the LC Display

2.1.1 General Error Messages

Display	Causes of error	Remedial action
	Minimum input value has been reached	Do not reduce value further
	Maximum input value has been reached	Do not increase value further
CMD error	Signal error Set-point value position controller	Check signal
SP error	Signal error Set-point value process controller	Check signal
PV error	Signal error Actual value process controller	Check signal
PT100 error	Signal error Actual value Pt-100	Check signal
invalid code	Incorrect access code	Input correct access code
EEPROM fault	EEPROM defective	not possible, device defective
MFI fault *	Field bus board defective	

* *field bus only*

2.1.2 Error Messages while the *X.TUNE* Function is Running

Display	Causes of error	Remedial action
X.TUNE locked	The *X.TUNE* function is blocked	Input access code
X.TUNE ERROR 1	No compressed air connected	Connect compressed air
X.TUNE ERROR 2	Compressed air failed during Autotune	Check compressed air supply
X.TUNE ERROR 3	Actuator or control system deaeration side leaking	not possible, device defective
X.TUNE ERROR 4	Control system aeration side leaking	not possible, device defective
X.TUNE ERROR 6	The end positions for *POS-MIN* and *POS-MAX* are too close together	Check compressed air supply
X.TUNE ERROR 7	Incorrect assignment *POS-MIN* and *POS-MAX*	To determine *POS-MIN* and *POS-MAX* , move the actuator in the direction indicated on the display.

2.1.3 Error Messages while the *P.Q'LIN* Function is Running

Display	Causes of error	Remedial action
P.Q LIN ERROR 1	No supply pressure connected	Connect supply pressure
	No change to process variable	Check process and, if required, switch on pump or open the shut-off valve
P.Q LIN ERROR 2	Current node of the valve stroke was not reached, as	
	▪ supply pressure failed during *P.Q'LIN*	Check supply pressure
	▪ Autotune was not run	Run Autotune

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2.1.4 Error Messages on Field Bus Devices

Display	Device status	Explanation/Troubleshooting
BUS offline is displayed approx. every 3 seconds	offline	Device is not connected to the bus, the network access procedure (duplicate MAC-ID test, duration approx. 2 s) has still not ended or device is only active network node ▪ Baudrate correctly set across network? ▪ Bus connection including plug assignment correct? ▪ Power supply and bus connection of the other nodes correct?
BUS no connection is displayed approx. every 3 seconds	online, no connection to the master	Device is connected correctly to the bus, the network access procedure has ended without errors, however there is no established connection to the master.
BUS no timeout is displayed approx. every 3 seconds	I/O connection timeout	An I/O connection is in the *TIME OUT* state. → New connection establishment by master; ensure that I/O data is transferred cyclically or, if *COS* confirmed, that corresponding Acknowledge messages are sent by the master.
BUS critical err is displayed approx. every 3 seconds	Critical bus error	Other device with the same address in the network or *BUS OFF* due to communication problems. → Change address of the device and restart device → Error analysis in the network with a bus monitor.

2.2 Other Malfunctions

Problem	Possible causes	Remedial action
POS = 0 (when *CMD* > 0 %) or *POS* = 100 %, (when *CMD* < 100 %) *PV* = 0 (when *SP* > 0) or *PV* = *PV* (when *SP* > *SP*)	Sealing function (*CUTOFF*) has been unintentionally activated	Deactivate sealing function
Applies only to devices with binary output: Binary output does not switch	Binary output: Current > 100 mA Short-circuit	Check binary output connection
Applies only to devices with process controller: Device is not operating as a controller, despite correctly implemented settings.	*P.CONTROL* menu option is in the main menu. The device is therefore operating as a process controller and expects a process actual value at the corresponding input.	Remove *P.CONTROL* menu option from the main menu.

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Packaging, Storage and Disposal

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1 PACKAGING AND TRANSPORT

NOTICE!

Transport damages!

Inadequately protected equipment may be damaged during transport.

- Protect the unit against wet and dirt during transport and pack safely in shock-resistant packaging.
- Avoid the effects of heat and cold which could result in temperatures above or below the permitted storage temperature.

2 STORAGE

NOTICE!

Incorrect storage may damage the device.

- Store the device in a dry and dust-free location!
- Storage temperature: -20 ... +65°C

3 DISPOSAL

→ Dispose of the device and packaging in an environmentally friendly manner.

NOTICE!

Damage to the environment caused by device components contaminated with media.

- Observe the relevant disposal and environmental protection regulations.

Note:
Observe the national waste disposal regulations.

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General Rules (Appendix)

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1 SELECTION CRITERIA FOR CONTINUOUS VALVES

The following criteria are crucial for optimum control behaviour and to ensure that the required maximum flow is reached:

- the correct selection of the flow coefficient which is defined primarily by the nominal width of the valve;
- close coordination between the nominal width of the valve and the pressure conditions in consideration of the remaining flow resistance in the equipment.

Design guidelines can be given on the basis of the flow coefficient (k_V value). The k_V value refers to standardised conditions with respect to pressure, temperature and media properties.

The k_V value describes the flow rate of water through a component in m³/h at a pressure difference of Δp = 1 bar and T = 20 °C.

The "k_{VS} value" is also used for continuous valves. This indicates the k_V value when the continuous valve is fully open.

Depending on the specified data, it is necessary to differentiate between the two following cases when selecting the valve:

a) The pressure values p1 and p2, known before and after the valve, represent the required maximum flow Q_{max} which is to be reached:

The required k_{VS} value is calculated as follows:

$$k_{vs} = Q_{max} \cdot \sqrt{\frac{\Delta p_0}{\Delta p}} \cdot \sqrt{\frac{\rho}{\rho_0}} \qquad (1)$$

Meaning of the symbols:

k_{VS}	flow coefficient of the continuous valve when fully open [m³/h]
Q_{max}	maximum volume flow rate [m³/h]
Δp_0	= 1 bar; pressure loss on the valve according to the definition of the k_V value
ρ_0	= 1000 kg/m³; density of water (according to the definition of the k_V value)
Δp	pressure loss on the valve [bar]
ρ	density of the medium [kg/m³]

b) The pressure values, known at the input and output of the entire equipment (p_1 and p_2), represent the required maximum flow Q_{max} which is to be reached:

1st step: Calculate the flow coefficient of the entire equipment k_{Vges} according to equation (1).

2nd step: Determine the flow rate through the equipment without the continuous valve (e.g. by "short-circuiting" the line at the installation location of the continuous valve).

3rd step: Calculate the flow coefficient of the equipment without the continuous valve (k_{Va}) according to equation (1).

4th step: Calculate the required k_{VS} value of the continuous valve according to equation (2):

$$k_{vs} = \sqrt{\frac{1}{\frac{1}{k_{Vges}^2} - \frac{1}{k_{Va}^2}}} \qquad (2)$$

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The k_{VS} value of the continuous valve should have at least the value which is calculated according to equation (1) or (2) which is appropriate to the application, however it should never be far above the calculated value.

The rule of thumb "slightly higher is never harmful" often used for switching valves may greatly impair the control behaviour of continuous valves!

The upper limit for the k_{VS} value of the continuous valve can be specified in practice via the so-called valve authority Ψ:

$$\psi = \frac{(\Delta p)_{v0}}{(\Delta p)_0} = \frac{k_{va}^2}{k_{va}^2 + k_{vs}^2} \qquad (3)$$

$(\Delta p)_{v0}$ Pressure drop over the fully opened valve

$(\Delta p)_0$ Pressure drop over the entire equipment

If the valve authority Ψ < 0.3, the continuous valve has been oversized.

When the continuous valve is fully open, the flow resistance in this case is significantly less than the flow resistance of the remaining fluid components in the equipment. This means that the valve position predominates in the operating characteristic in the lower opening range only. For this reason the operating characteristic is highly deformed.

By selecting a progressive (equal percentage) transfer characteristic between position nominal value and valve stroke, this can be partially compensated and the operating characteristic linearised within certain limits. **However, the valve authority Ψ should also be > 0.1 if a correction characteristic is used.**

The control behaviour (control quality, transient time) depends greatly on the working point if a correction characteristic is used.

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2 PROPERTIES OF PID CONTROLLERS

A PID controller has a proportional, an integral and a differential portion (P, I and D portion).

2.1 P Portion

Function:

$$Y = Kp \cdot Xd \quad (4)$$

Kp is the proportional coefficient (amplification factor). It is the ratio of the adjusting range ΔY to the proportional range ΔXd.

Characteristic and step response of the P portion of a PID controller

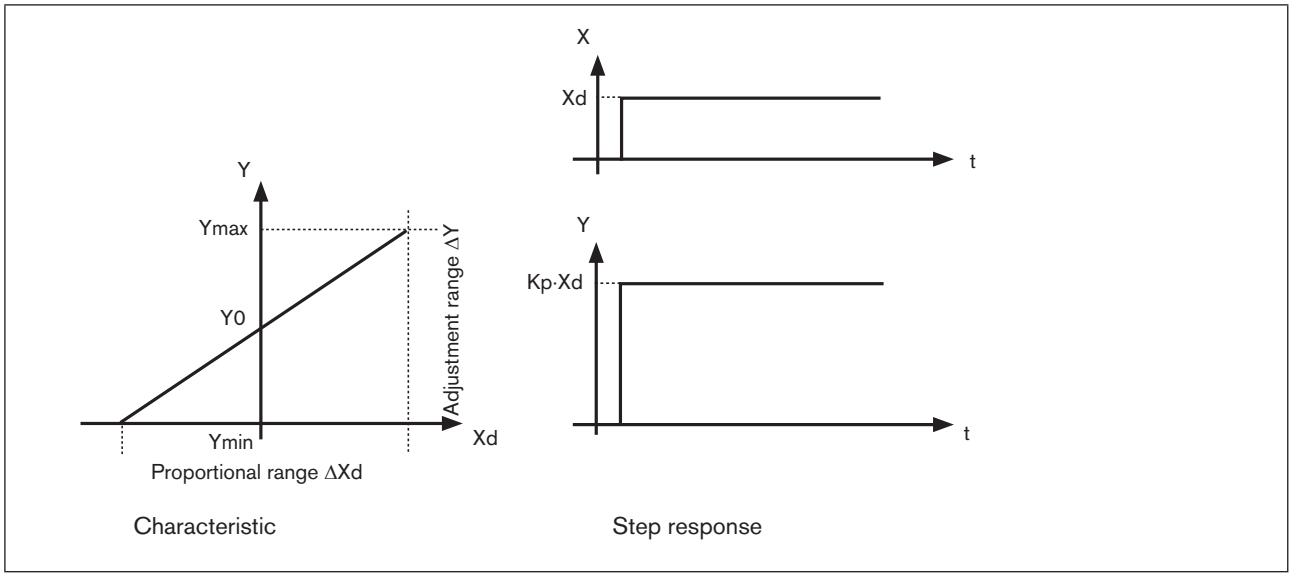

Fig. 1: Characteristic and step response of the P portion of a PID controller

Properties

In theory a pure P-controller functions instantaneously, i.e. it is quick and therefore dynamically favourable. It has a constant control difference, i.e. it does not fully correct the effects of malfunctions and is therefore statically relatively unfavourable.

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2.2 I Portion

Function:

$$Y = \frac{1}{Ti} \int X \, d \, dt \qquad (5)$$

Ti is the integral action time or actuating time. It is the time which passes until the actuating variable has run through the whole adjustment range.

Characteristic and step response of the I portion of a PID controller

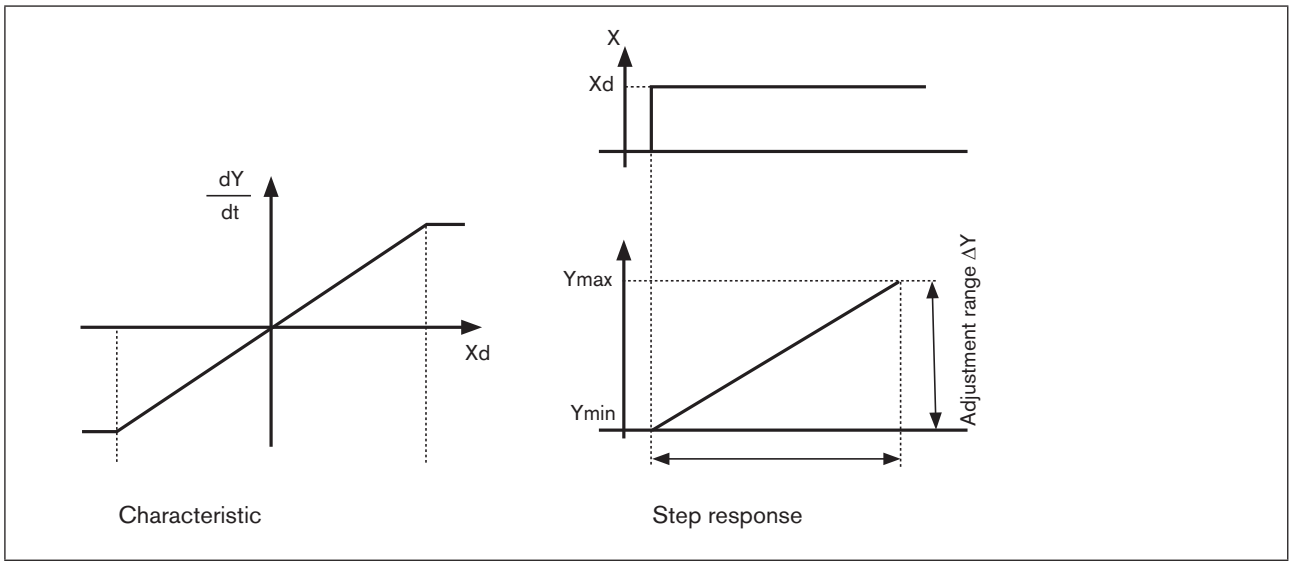

Fig. 2: Characteristic and step response of the I portion of a PID controller

Properties

A pure I-controller completely eliminates the effects of any malfunctions which occur. It therefore has a favourable static behaviour. On account of its final actuating speed control it operates slower than the P-controller and has a tendency to oscillate. It is therefore dynamically relatively unfavourable.

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2.3 D Portion

Function:

$$Y = K_d \cdot \frac{dX_d}{dt} \qquad (6)$$

Kd is the derivative action coeffficient. The larger Kd is, the greater the D-effect is.

Characteristic and step response of the I portion of a PID controller

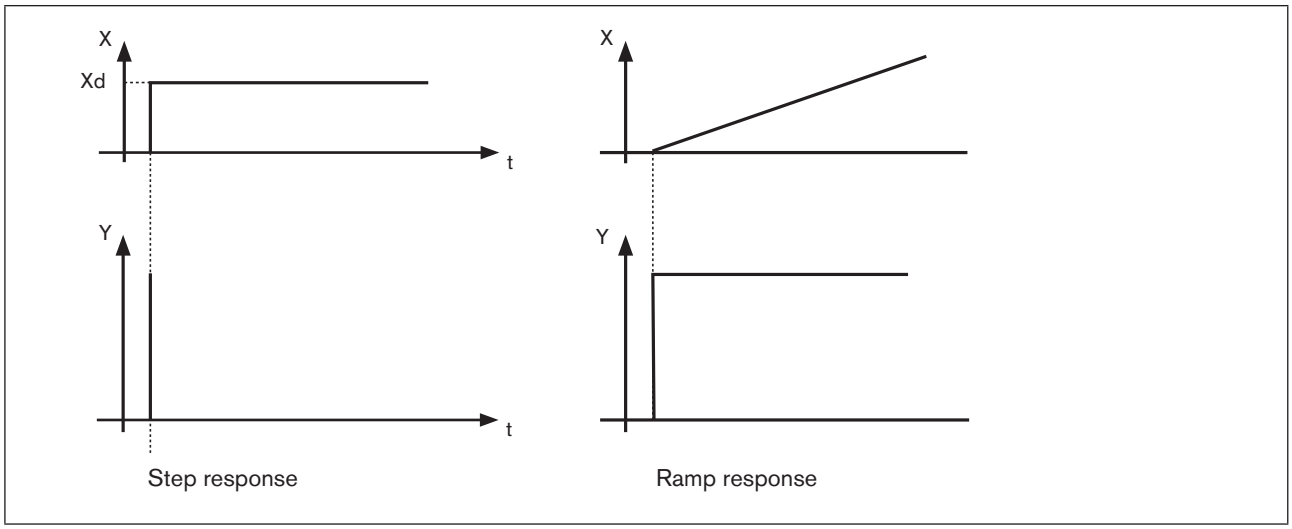

Fig. 3: Characteristic and step response of the D portion of a PID controller

Properties

A controller with a D portion responds to changes in the control variable and may therefore reduce any control differences more quickly.

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2.4 Superposition of P, I and D Portions

Function:

$$Y = Kp \cdot Xd + \frac{1}{Ti}\int Xd\,dt + Kd\frac{dXd}{dt} \qquad (7)$$

Where Kp · Ti = Tn and Kd/Kp = Tv the **function of the PID controller** is calculated according to the following equation:

$$Y = Kp \cdot \left(Xd + \frac{1}{Tn}\int Xd\,dt + Tv\frac{dXd}{dt}\right) \qquad (8)$$

Kp	Proportional coefficient / amplification factor
Tn	Reset time (Time which is required to obtain an equally large change in the actuating variable by the I portion as occurs with the P portion)
Tv	Derivative time (Time by which a certain actuating variable is reached earlier on account of the D portion than with a pure P-controller)

Step response and ramp response of the PID controller

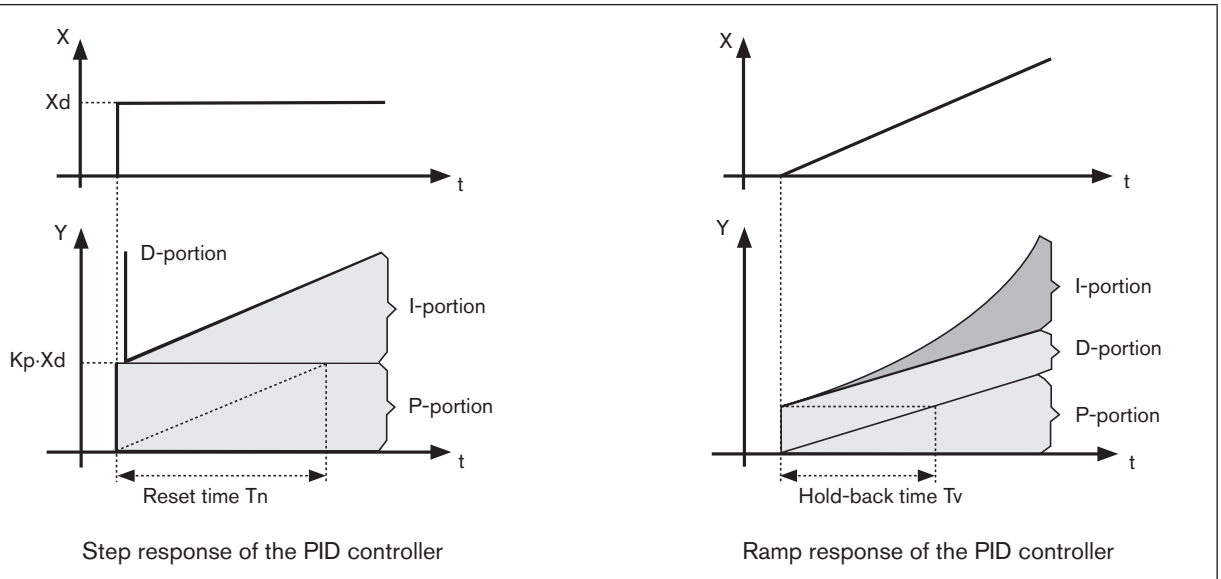

Fig. 4: Characteristic of step response and ramp response of PID controller

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2.5 Implemented PID Controller

2.5.1 D Portion with Delay

In the process controller of the positioner the D portion is implemented with a delay T.
Function:

$$T \cdot \frac{dY}{dt} + Y = Kd \cdot \frac{dXd}{dt} \qquad (9)$$

Superposition of P, I and DT Portions

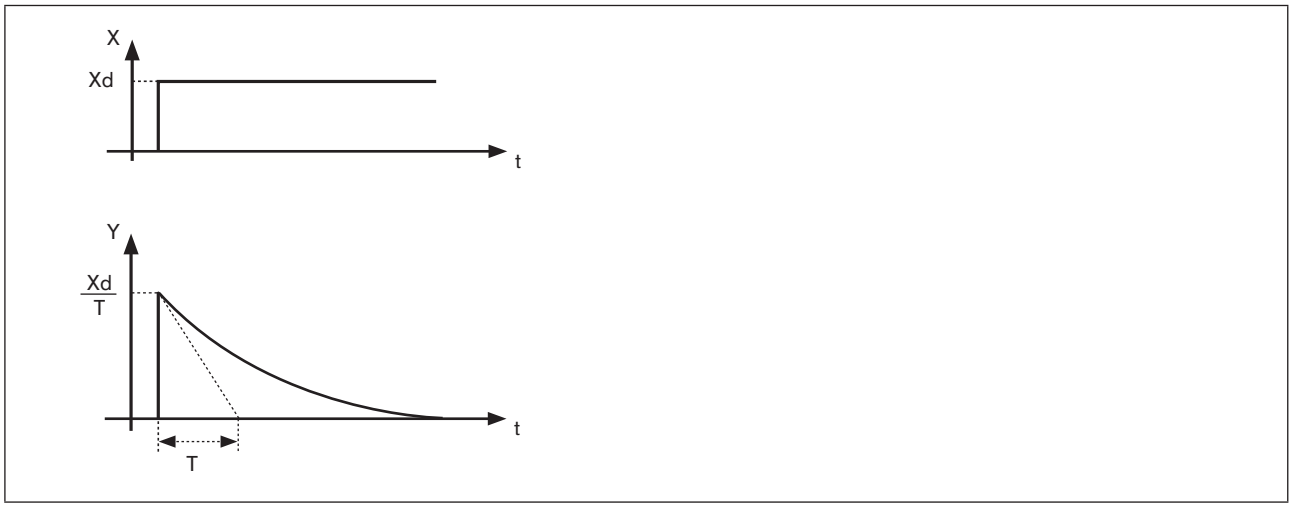

Fig. 5: Characteristic of superposition of P, I and DT Portions

2.5.2 Function of the Real PID Controller

$$T \cdot \frac{dY}{dt} + Y = Kp\left(Xd + \frac{1}{Tn}\int Xd\,dt + Tv\,\frac{dXd}{dt}\right) \qquad (10)$$

Superposition of P, I and DT Portions

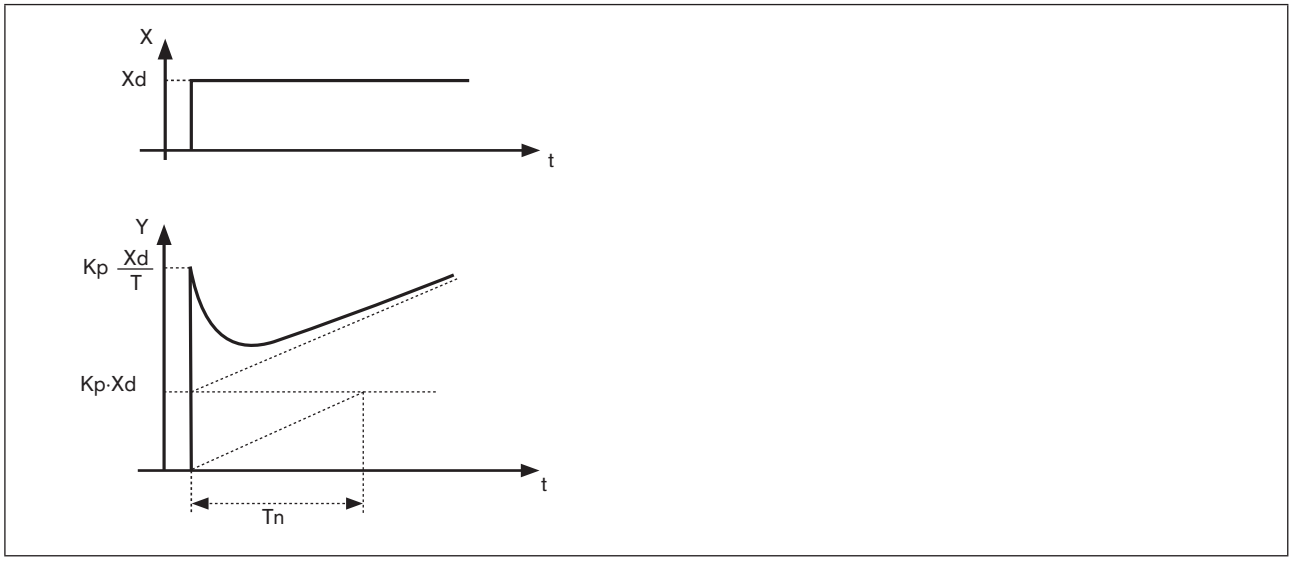

Fig. 6: Characteristic of step response of the Real PID Controller

3 ADJUSTMENT RULES FOR PID CONTROLLERS

The regulatory literature includes a series of adjustment rules which can be used in experimental ways to determine a favourable setting for the controller parameters. To avoid incorrect settings, always observe the conditions under which the particular adjustment rules have been drawn up. Apart from the properties of the control process and the controller itself, spielt dabei eine Rolle, whether a change in the disturbance variable or command variable is to be corrected.

3.1 Adjustment Rules according to Ziegler and Nichols (Oscillation Method)

With this method the controller parameters are adjusted on the basis of the behaviour of the control circuit at the stability limit. The controller parameters are first adjusted so that the control circuit starts to oscillate. The occurring critical characteristic values suggest a favourable adjustment of the controller parameters. A prerequisite for the application of this method of course is that the control circuit is oscillated.

Procedure

→ Set controller as P-controller (i.e. Tn = 999, Tv = 0), first select a low value for Kp

→ Set required set-point value

→ Increase Kp until the control variable initiates an undamped continuous oscillation.

The proportionality coefficient (amplification factor) set at the stability limit is designated as K_{krit}. The resulting oscillation duration is designated as T_{krit}.

Progress of the control variable at the stability limit

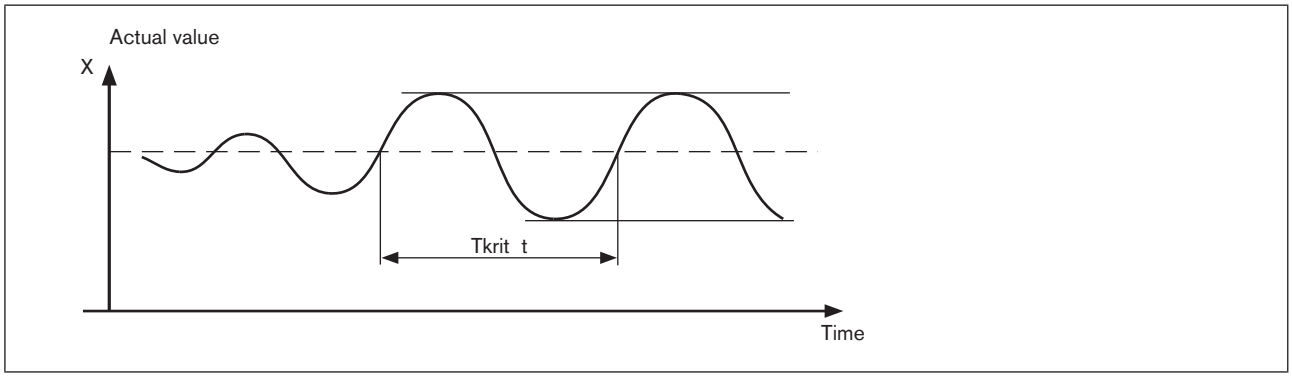

Fig. 7: Progress of the control variable PID

The controller parameters can then be calculated from K_{krit} and T_{krit} according to the following table.

Adjustment of the parameters according to Ziegler and Nichols

Controller type	Adjustment of the parameters		
P controller	Kp = 0.5 K_{krit}	-	-
PI controller	Kp = 0.45 K_{krit}	Tn = 0.85 T_{krit}	-
PID controller	Kp = 0.6 K_{krit}	Tn = 0.5 T_{krit}	Tv = 0.12 T_{krit}

The adjustment rules of Ziegler and Nichols have been determined for P-controlled systems with a time delay of the first order and dead time. However, they apply only to controllers with a disturbance reaction and not to those with a reference reaction.

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3.2 Adjustment Rules according to Chien, Hrones and Reswick (Actuating Variable Jump Method)

With this method the controller parameters are adjusted on the basis of the transient behaviour of the controlled system. An actuating variable jump of 100 % is output. The times Tu and Tg are derived from the progress of the actual value of the control variable.

Progress of the control variable following an actuating variable jump ΔY

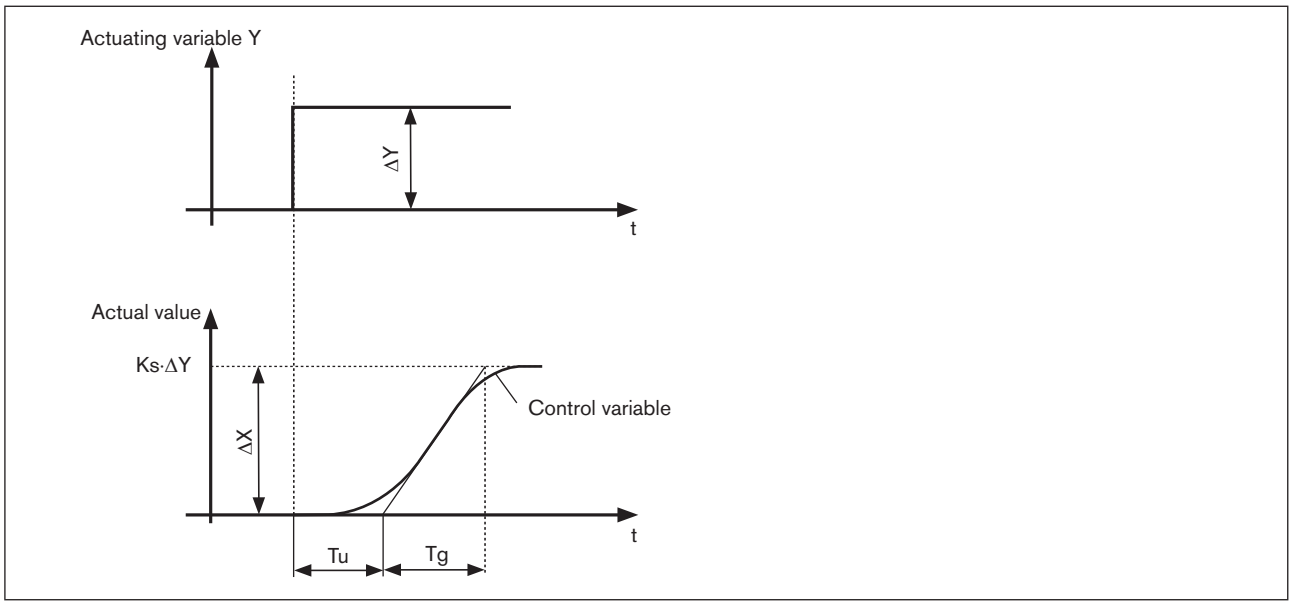

Fig. 8: Progress of the control variable, actuating variable jump

Procedure

→ Switch controller to MANUAL (MANU) operating state

→ Output the actuating variable jump and record control variable with a recorder

→ If progresses are critical (e.g. danger of overheating), switch off promptly.

Note that in thermally slow systems the actual value of the control variable may continue to rise after the controller has been switched off.

In the following table the adjustment values have been specified for the controller parameters, depending on Tu, Tg and Ks for reference and disturbance reaction, as well as for an aperiodic control process and a control process with a 20 % overshoot. They apply to controlled systems with P-behaviour, with dead time and with a delay of the first order.

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Adjustment of the parameters according to Chien, Hrones and Reswick

Controller type	Adjustment of the parameters for aperiodic control process (0 % overshoot)		Adjustment of the parameters for control process with 20 % overshoot	
	Reference	Malfunction	Reference	Malfunction
P controller	$Kp = 0{,}3 \cdot \frac{Tg}{Tu \cdot Ks}$	$Kp = 0{,}3 \cdot \frac{Tg}{Tu \cdot Ks}$	$Kp = 0{,}7 \cdot \frac{Tg}{Tu \cdot Ks}$	$Kp = 0{,}7 \cdot \frac{Tg}{Tu \cdot Ks}$
PI controller	$Kp = 0{,}35 \cdot \frac{Tg}{Tu \cdot Ks}$ $Tn = 1{,}2 \cdot Tg$	$Kp = 0{,}6 \cdot \frac{Tg}{Tu \cdot Ks}$ $Tn = 4 \cdot Tu$	$Kp = 0{,}6 \cdot \frac{Tg}{Tu \cdot Ks}$ $Tn = Tg$	$Kp = 0{,}7 \cdot \frac{Tg}{Tu \cdot Ks}$ $Tn = 2{,}3 \cdot Tu$
PID controller	$Kp = 0{,}6 \cdot \frac{Tg}{Tu \cdot Ks}$ $Tn = Tg$ $Tv = 0{,}5 \cdot Tu$	$Kp = 0{,}95 \cdot \frac{Tg}{Tu \cdot Ks}$ $Tn = 2{,}4 \cdot Tu$ $Tv = 0{,}42 \cdot Tu$	$Kp = 0{,}95 \cdot \frac{Tg}{Tu \cdot Ks}$ $Tn = 1{,}35 \cdot Tg$ $Tv = 0{,}47 \cdot Tu$	$Kp = 1{,}2 \cdot \frac{Tg}{Tu \cdot Ks}$ $Tn = 2 \cdot Tu$ $Tv = 0{,}42 \cdot Tu$

The proportionality factor Ks of the controlled system is calculated as follows:

$$Ks = \frac{\Delta X}{\Delta Y} \qquad (11)$$

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Operating structure of the positioner (Appendix)

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1 OPERATING STRUCTURE OF THE POSITIONER

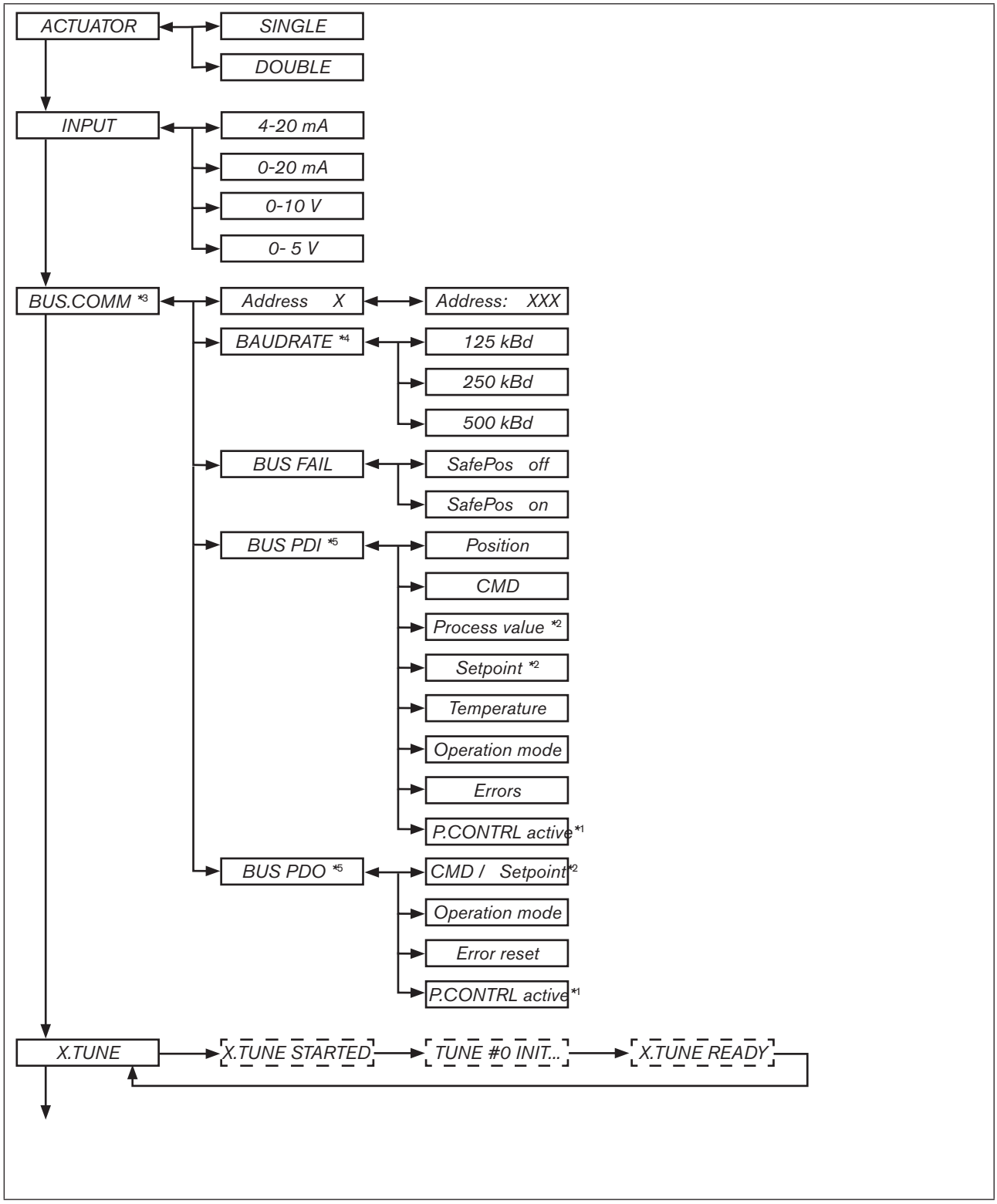

Fig. 1: Operating structure - 1

*1 only process controller 8693
*2 only process controller 8693 and activated process controller
*3 only field bus
*4 only DeviceNet
*5 only Profibus DP

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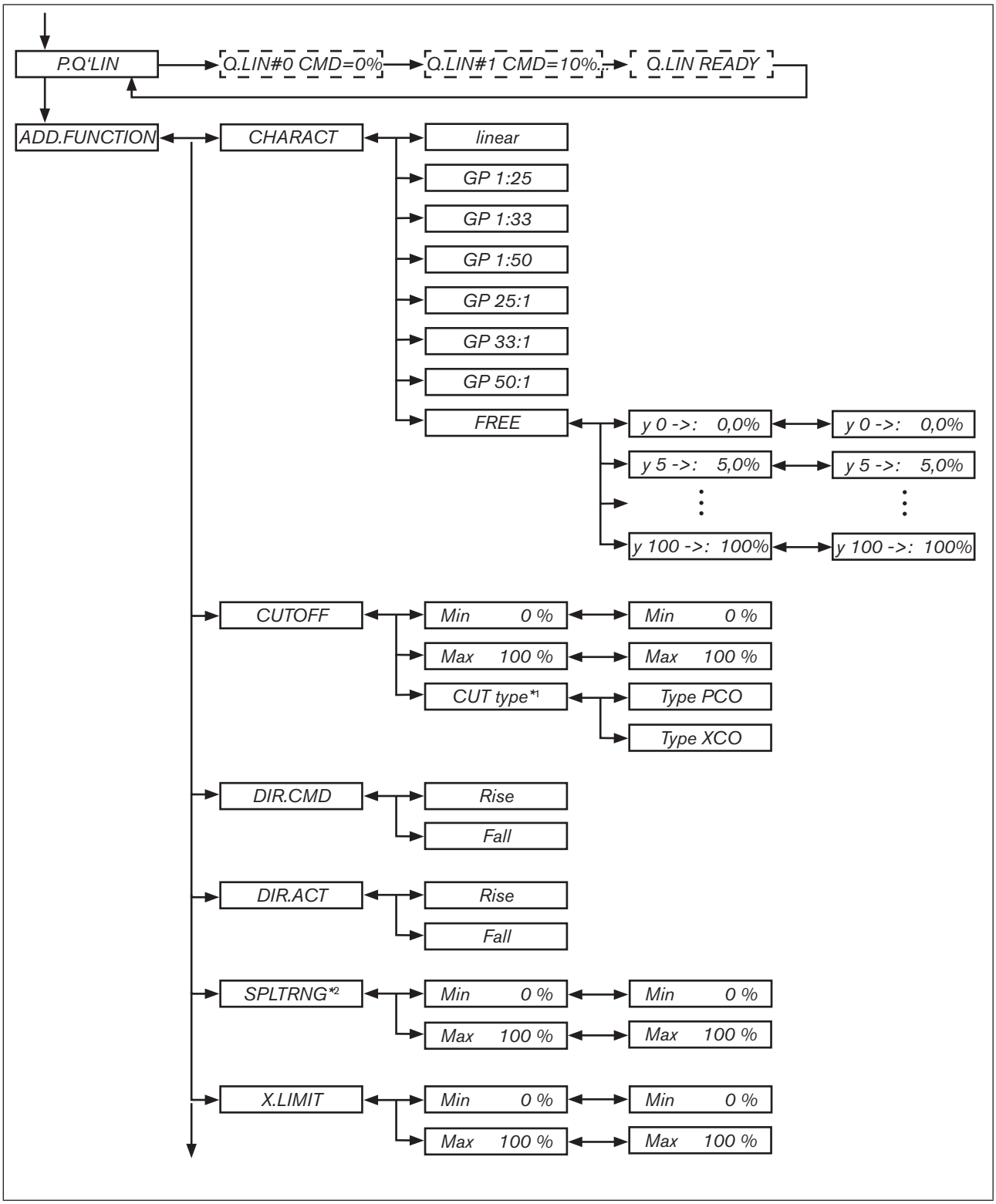

Fig. 2: Operating structure - 2

1 only process controller 8693
2 only position controller 8692

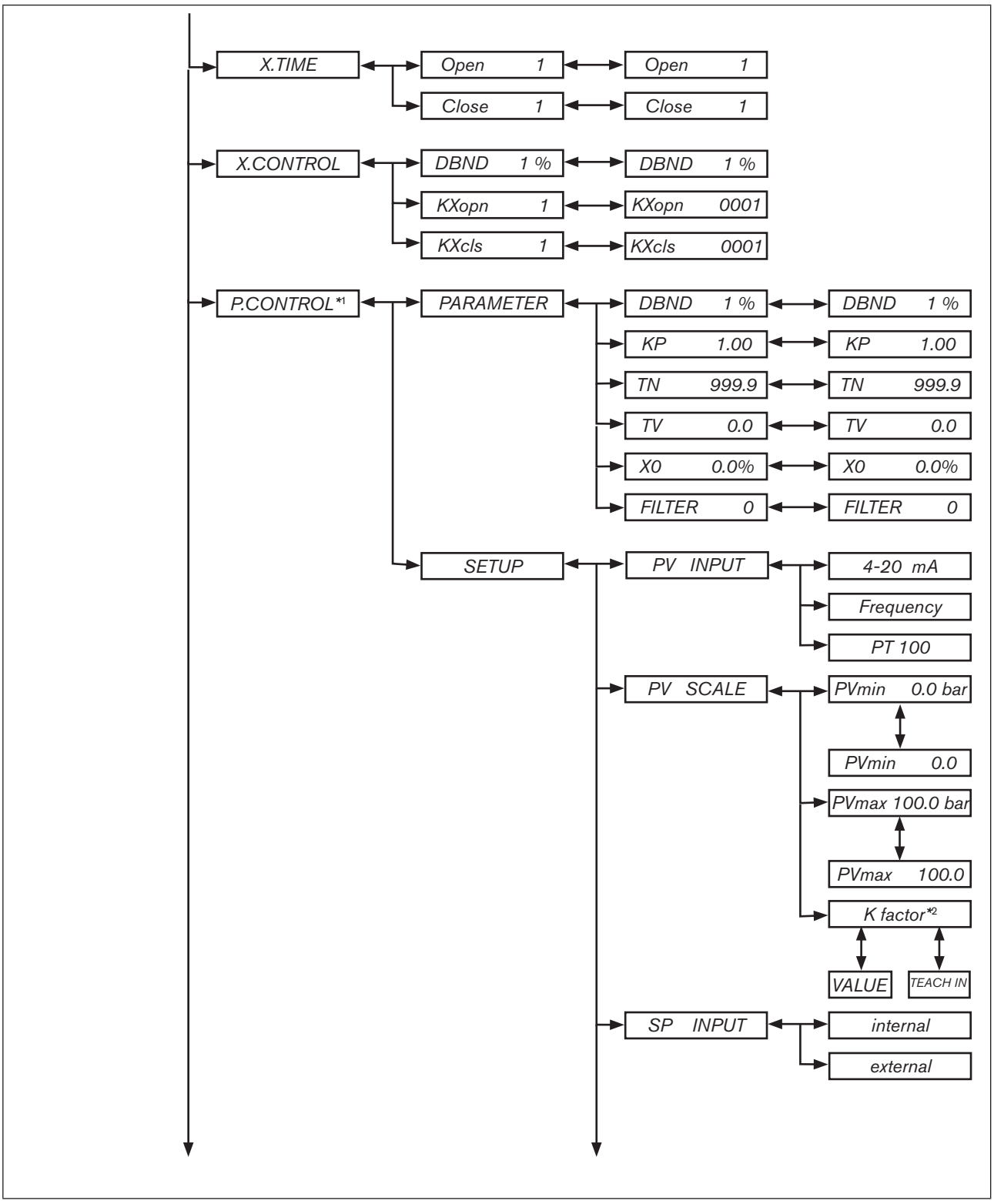

Fig. 3: Operating structure - 3

1 only process controller 8693
2 only for frequency signal type (PV INPUT / frequency)

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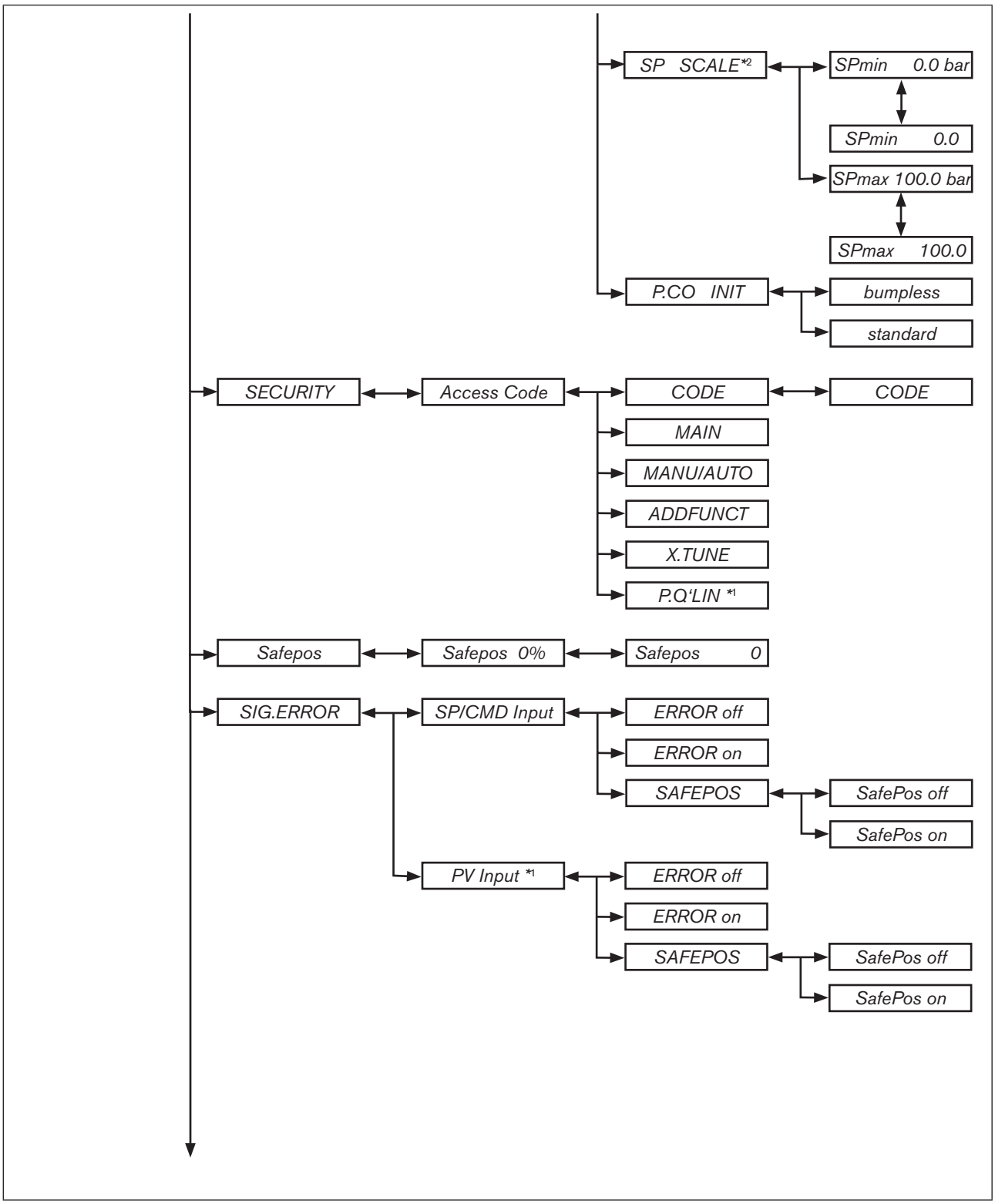

Fig. 4: Operating structure - 4

1 only process controller 8693
2 only for external set-point value default (SP INPUT / external)

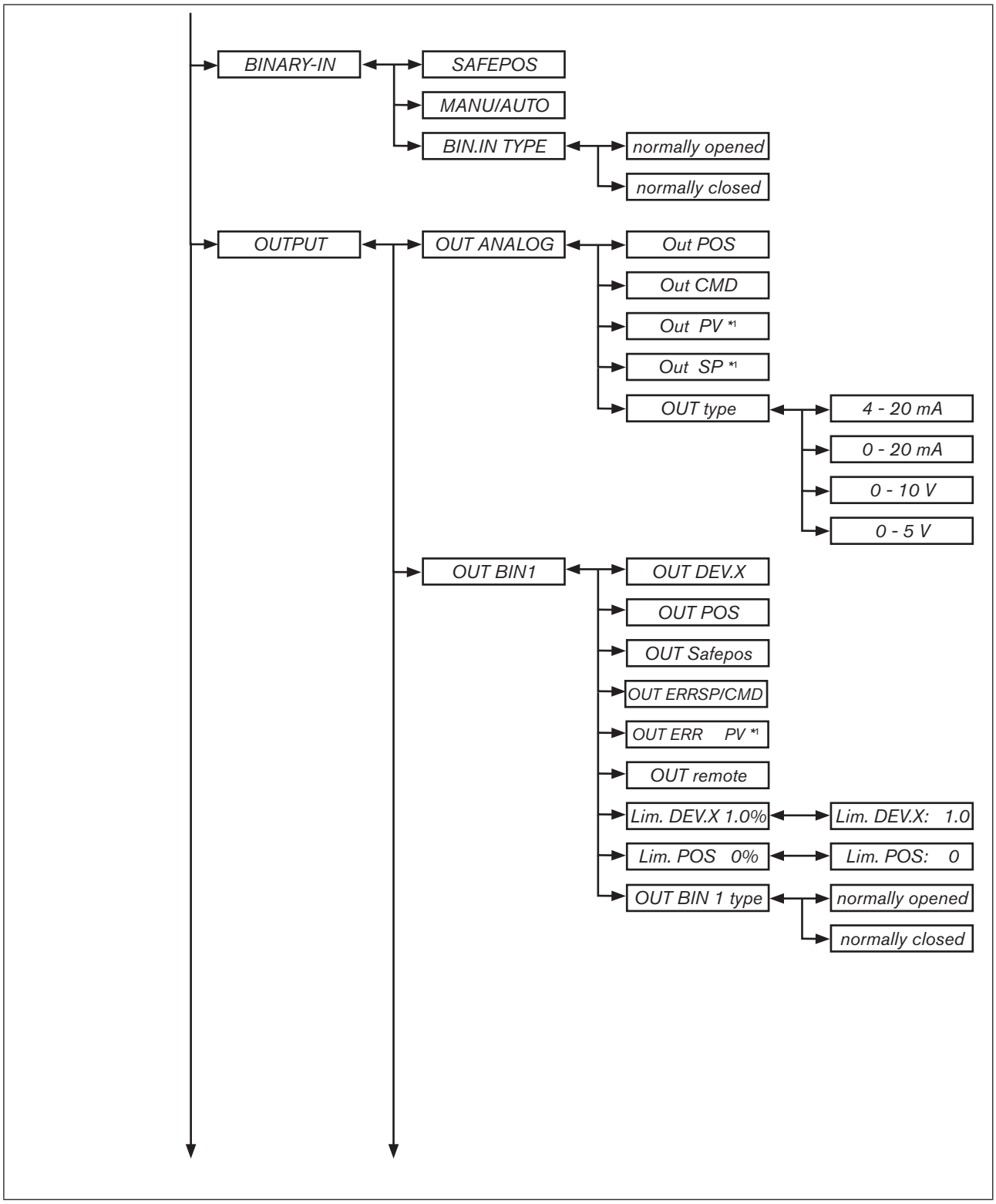

Fig. 5: Operating structure - 5

*1 only process controller

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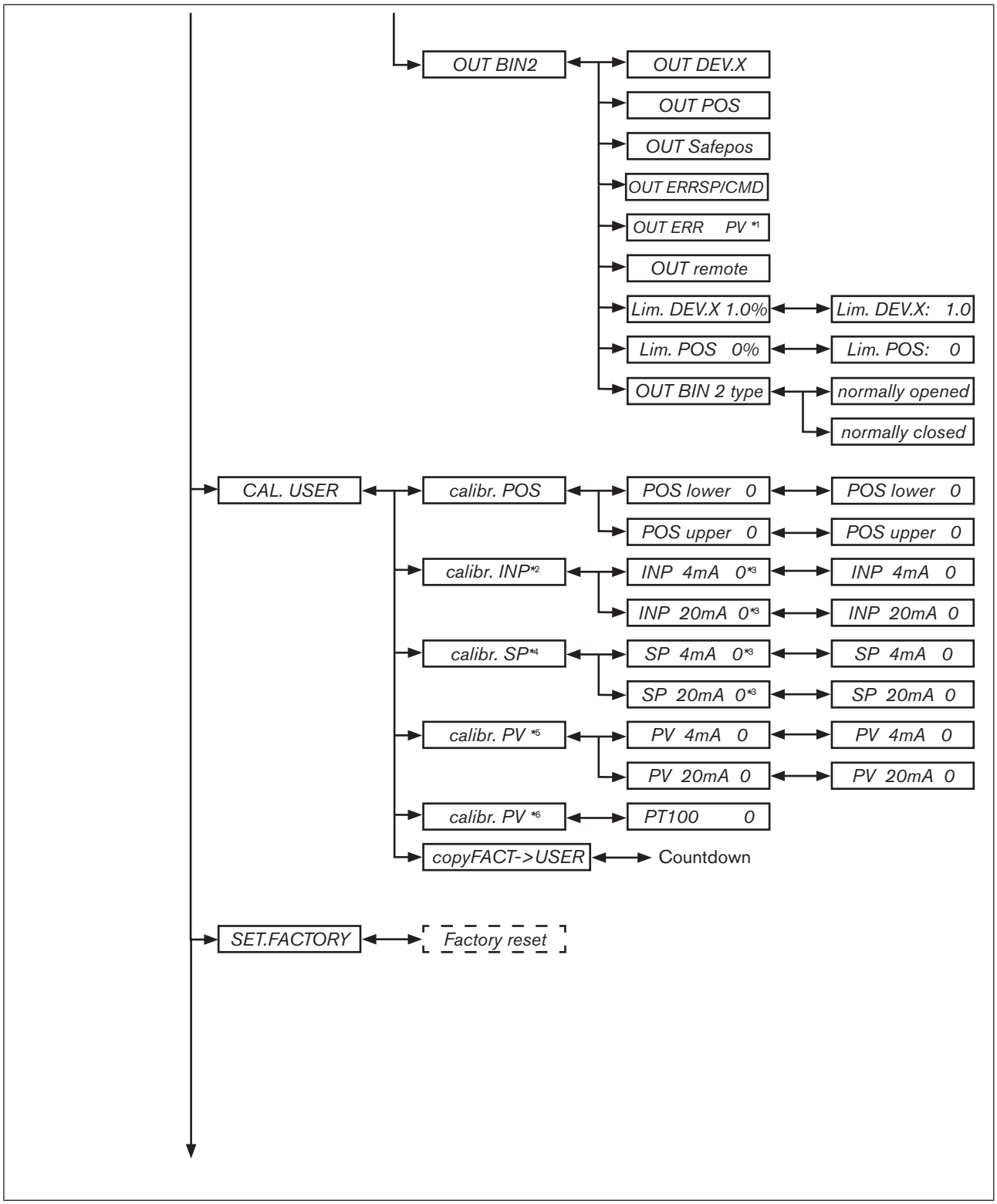

Fig. 6: Operating structure - 6

**1 only process controller 8693*
**2 only position controller 8692*
**3 The signal type is displayed which is selected in the INPUT menu*
**4 only 8693, only for external set-point value default (P.CONTROL / SETUP / SP-INPUT / external)*
**5 only 8693, only for signal type 4 – 20 mA*
**6 only 8693, only for circuit with PT 100*

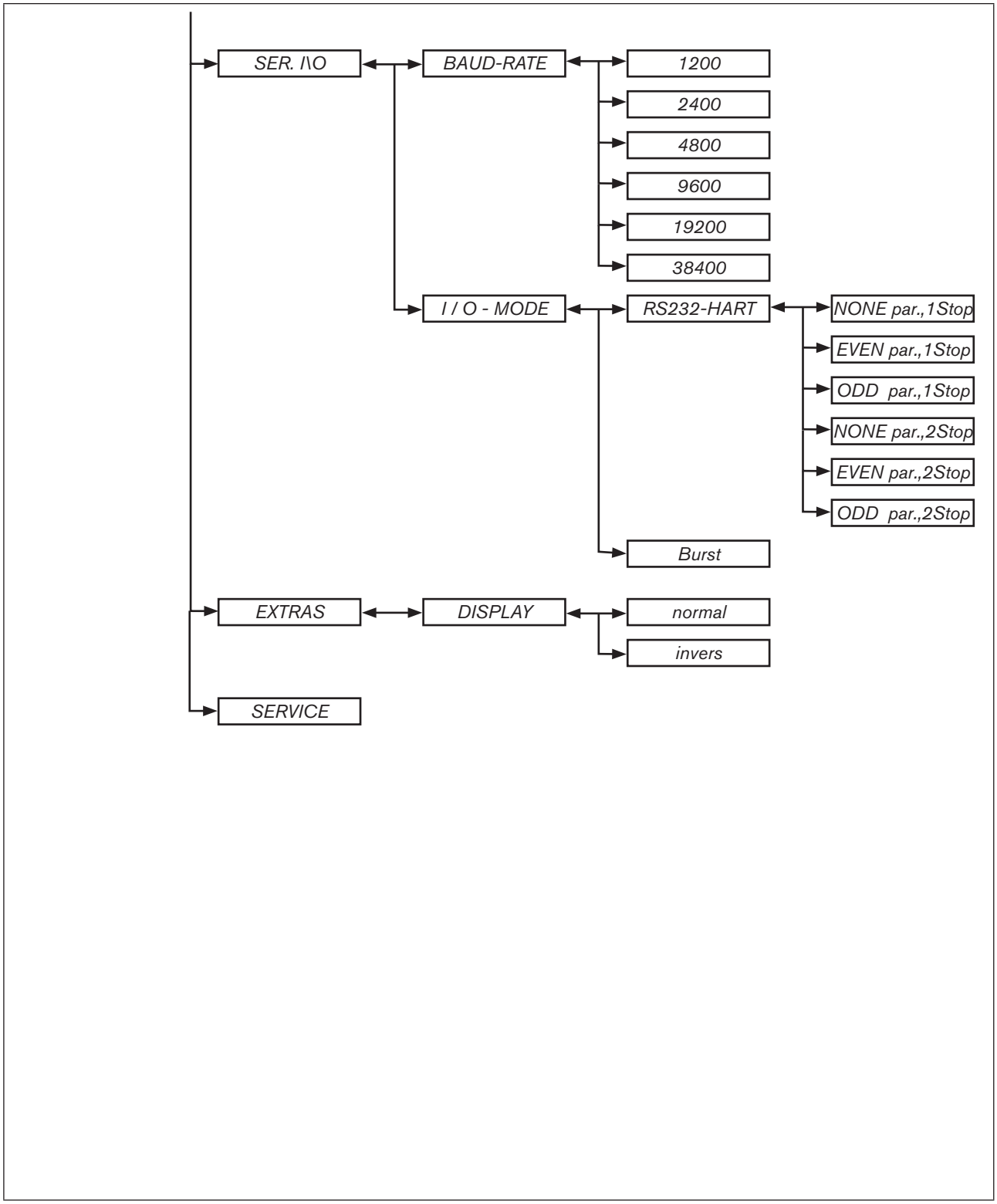

Fig. 7: Operating structure - 7

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Position Controller Table Type 8692 (Appendix)

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1 TABLE FOR YOUR SETTINGS ON THE POSITION CONTROLLER

1.1 Settings of the Freely Programmable Characteristic

Node (position set-point value as %)	Valve stroke [%]			
	Date:	Date:	Date:	Date:
0				
5				
10				
15				
20				
25				
30				
35				
40				
45				
50				
55				
60				
65				
70				
75				
80				
85				
90				
95				
100				

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Process Controller Table Type 8693 (Appendix)

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1 TABLE FOR YOUR SETTINGS ON THE PROCESS CONTROLLER

1.1 Settings of the Freely Programmable Characteristic

Node (position set-point value as %)	Valve stroke [%]			
	Date:	Date:	Date:	Date:
0				
5				
10				
15				
20				
25				
30				
35				
40				
45				
50				
55				
60				
65				
70				
75				
80				
85				
90				
95				
100				

1.2 Set Parameters of the Process Controller

	Date:	Date:	Date:	Date:
KP				
TN				
TV				
X0				
DBND				
DP				
PVmin				
PVmax				
SPmin				
SPmax				
UNIT				
K factor				
FILTER				
INP				

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Master code (Appendix)

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1 MASTER CODE

Mastercode

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